POPULAR SCIENCE

MONTHLY

MECHANICS AND HANDICRAFT

25¢ July

How to Build a PLASTIC PORCH PAGE 131

Wilbur Shaw Flies a Car PAGE 72

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Savage-Stevens "22"s scoring hits everywhere

Here are three "22's" that are scoring *hits* for value, dependability and performance with shooters everywhere. See these three different style rifles at your dealer's... lightning-fast auto-loader . . . smooth operating slide action repeater . . . handy, reliable single shot. Write for free catalog of Savage, Stevens and Fox shotguns and rifles.

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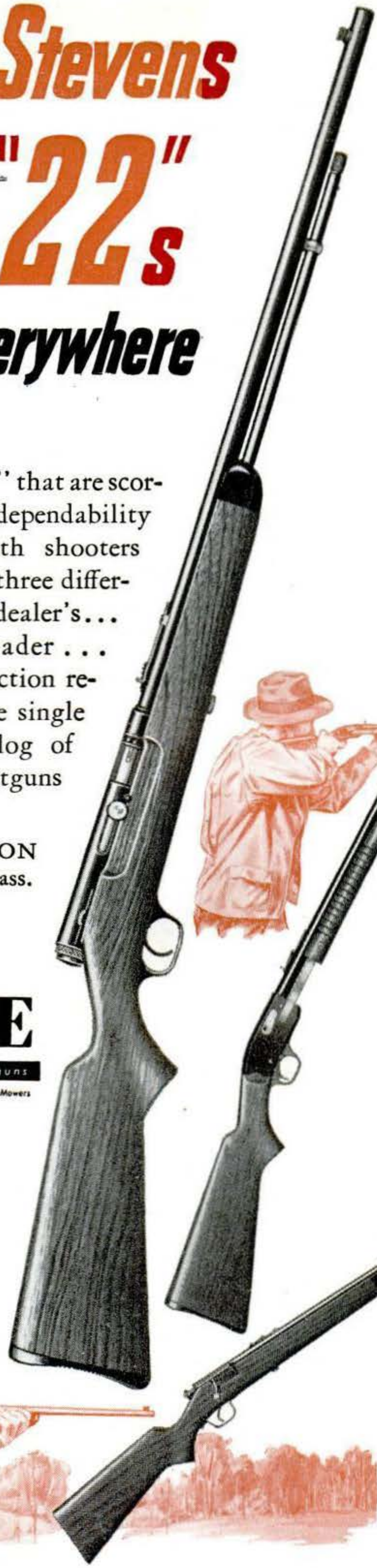

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MODEL 87

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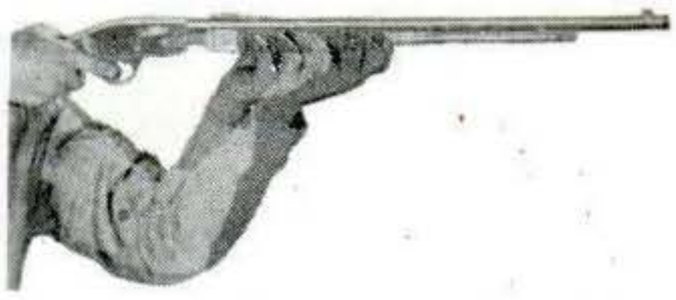

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Mechanics and Handicraft

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Those back issues of Popular Science Monthly on your shelf contain thousands of good ideas that never grow old. The fully cross-referenced index that starts on page 187 covers two volumes (a full year) of the Mechanics & Handicraft section, puts every article at your fingertips.

(More features and departments are listed on page 4.)

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NEXT MONTH . . .

Installing a Kitchen Fan

Does your kitchen feel like a slow oven these warm days? If greasy vapors condense on walls, or annoying cooking odors sweep through the house, there's a simple solution. An article in the August issue will tell you how to install an exhaust fan to give these troubles the bum's rush.

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Letters

Popular Science Monthly Honored

Congratulations!

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have been aware of all you have been doing for safety, and we are delighted that the judges agreed.

NED H. DEARBORN, President
National Safety Council, Chicago.

Other magazines honored with such an award by the National Safety Council this spring were The Reader's Digest, Redbook, Better Homes & Gardens, *and* Parade.

Do Train Wheels Slip?

Down here on the Norfolk & Western Railway we've been arguing over what happens to a pair of railroad-car wheels on a curve, where the outside wheel must travel farther than the inside one.

One side maintains that because the wheel edges are tapered they permit the outside wheel to travel farther without causing the inside one to slip. The other side (my side) maintains that the inside wheel does slip and that this compensates for the shorter distance it travels.

Could you help us settle the argument?

GEORGE A. WEBB, Norfolk, Va.

You're both partly right. On flat wheels there would be sure to be slippage. But for years all railroad-car wheels were tapered on the theory that the outside wheel would ride up on its greatest diameter, while the inside one would slide across to its smallest diameter. This reduced slippage to a minimum but produced a problem on straight track, where the wheels would tend to "hunt," or weave from side to side.

Believing that this hunting was worse than slipping, especially at high speeds, the Pennsylvania Railroad recently started making flat-edge wheels and liked them so much that they are now using them on all their cars. Whether other roads will follow suit nobody knows. Anyhow, as things stand now, tapered wheels don't slip—at least not much—and flat wheels do.

Antifreeze Won't Overheat Engine

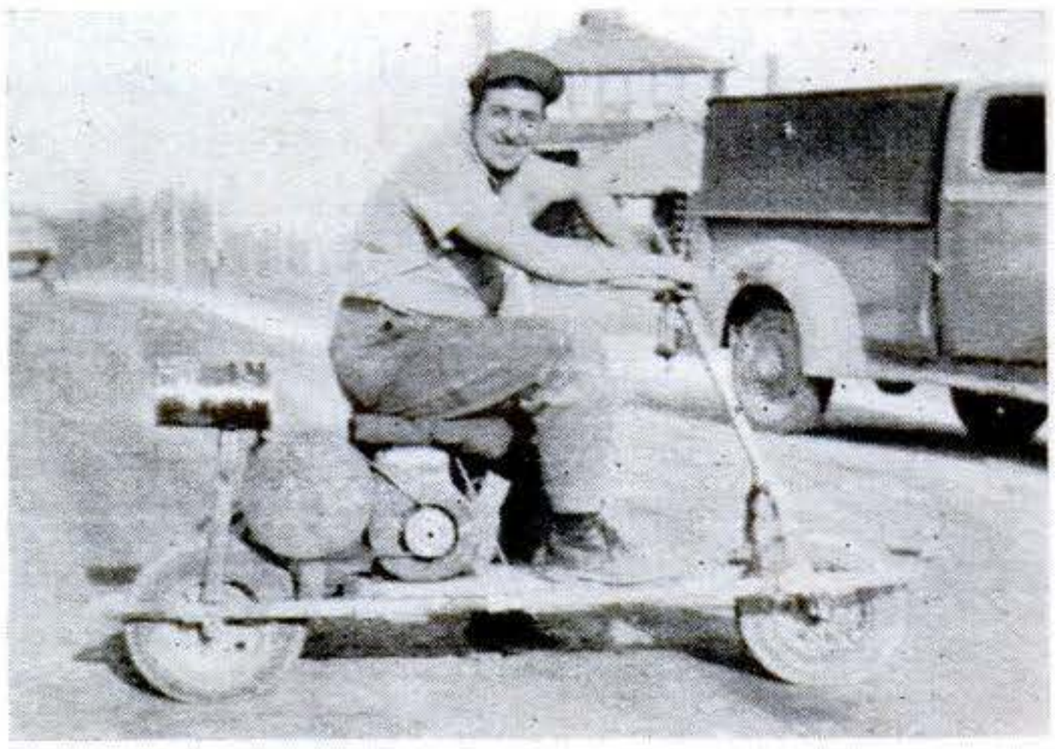
Could you please answer a question for us? Which will run cooler—a car engine with all water in the cooling system, or one with a permanent antifreeze mixture?

RANDALL COWLES, Detroit.

Ethylene glycol, the major constituent of a permanent-type antifreeze, has a lower heat-transfer capacity than water. Therefore, you might expect an engine with antifreeze to run hotter. But it doesn't. If the cooling-system thermostat is functioning properly, it will keep engine-operating temperature the same in both cases.

PSM Scooter Tours Alaska

I would like to tell you that maybe I was the first one to ride a scooter along the Alaska Highway before Mr. Bulstrode did ["Down the Alaska Highway on a One-Lung Scooter," May '52, p. 122].



I was with the R.C.A.F. at Teslin in the Yukon, and I made the scooter [above] from a picture in your magazine in 1946.

ROGER CLEMENT, Montreal.

Gear Garble

Why can't auto people express themselves intelligibly when they talk about gears? They tell me a 3-to-1 rear end is a lot higher than a 4-to-1 one, but 3 wasn't noticeably higher than 4 when I left school. And when they mention steering I really get confused. For instance: "The 15-to-1 steering is of

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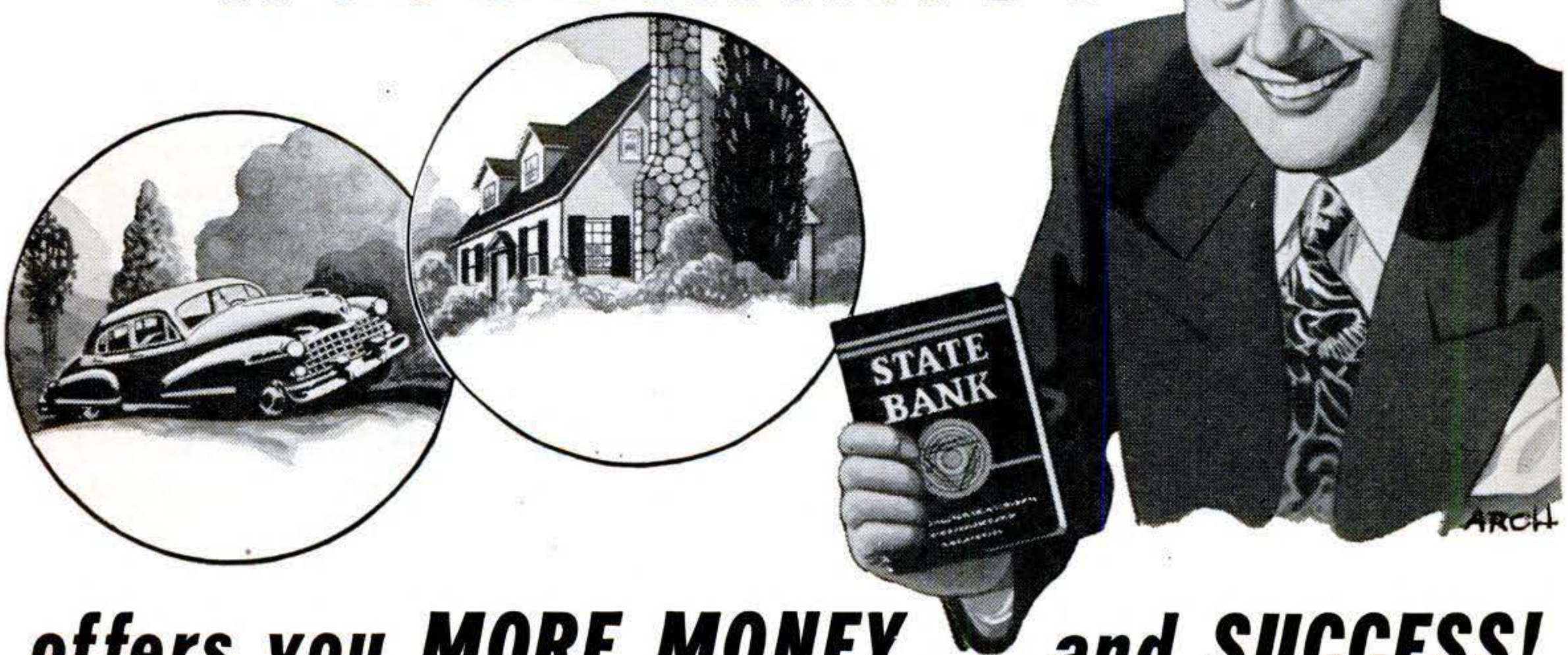

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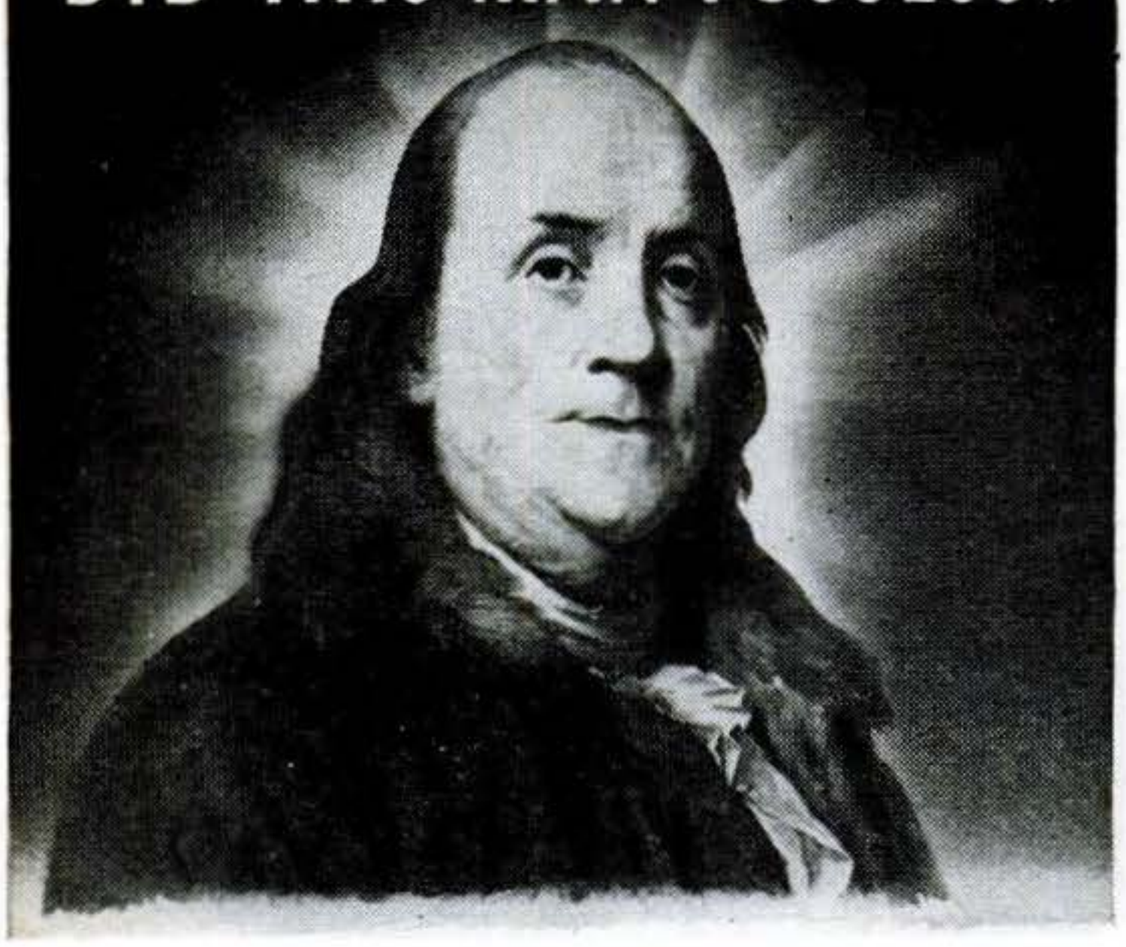

BENJAMIN FRANKLIN
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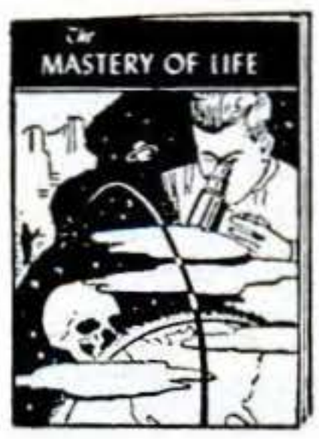

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course far faster than the conventional 22-to-1 deal." What in gobbledy-gook's name is that "faster" nonsense?

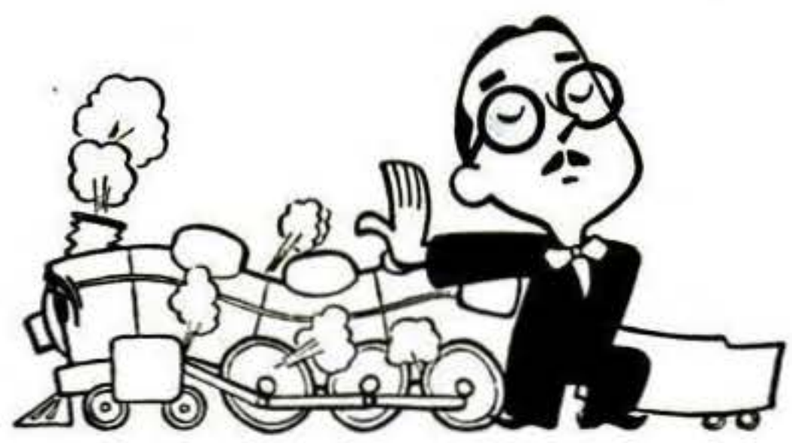
S. J. PRENTISS, Athens, Ga.

You can unscramble this confusion if you remember that the term gear *is not the same as the term* ratio; *in fact, the two are exactly opposite. The higher the* gear, *the lower the* ratio *(the lower the number in the ratio designation); and the lower the* gear, *the higher the* ratio. *Thus a 3-to-1 rear end is a higher* gear *than the 4-to-1, but it is a lower* ratio *because its number is lower.*

The same applies to steering, except that another factor is added—the time it takes you to turn the wheels from lock to lock. The 15-to-1 ratio takes fewer steering-wheel turns than the 22-to-1 ratio to produce the same front-wheel deflection. Thus the lower ratio takes less time and is said to be "faster."

Steam Locos Ride Again

Contained in your March issue [p. 150] is the most noteworthy article on motive power to appear in a non-railroad magazine in years. Author Henry B. Comstock, a former railroad-magazine editor, has at last presented accurate, untainted performance figures that do the modern, efficient Norfolk & Western steam locomotives justice.



Heretofore, editors have been given to displaying honeyed pooh-pooh in which 40-year-old steamers are always painted as extravagant and broken-down tramps beside rakish Diesel penny-pinchers. Why, that's like putting your cover-painting Ford up against a Model T.

H. REID, Norfolk, Va.

Cleaning Spark Plugs

Does it harm a spark plug to soak it in white gasoline and then scrape out the softened carbon?

JACK BASSLER, Temple, Tex.

This will do no harm, but you never will get the plug as clean as your garage man can in a couple of minutes with a sand-blaster made especially for the purpose.

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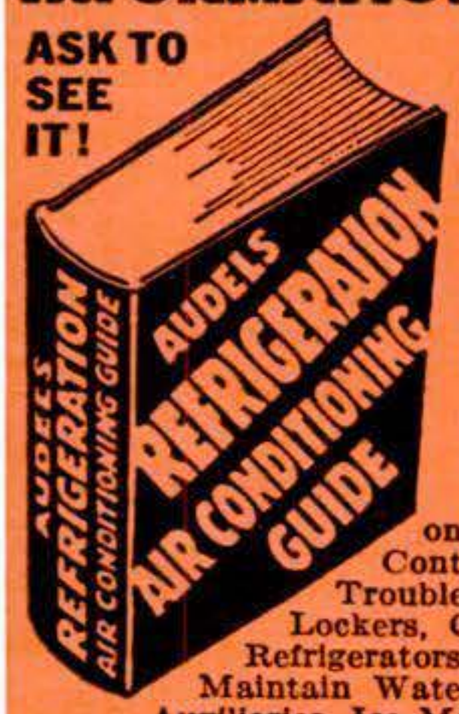

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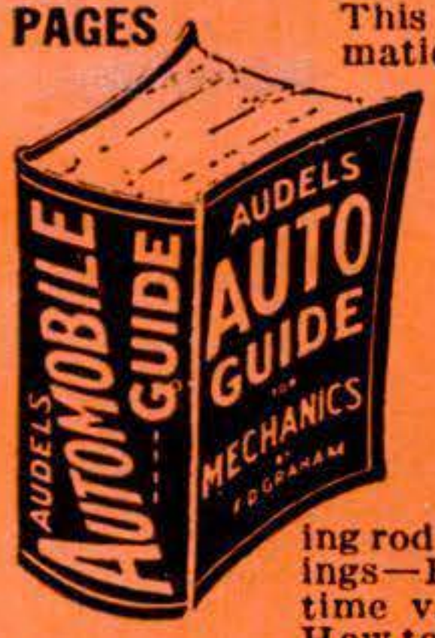

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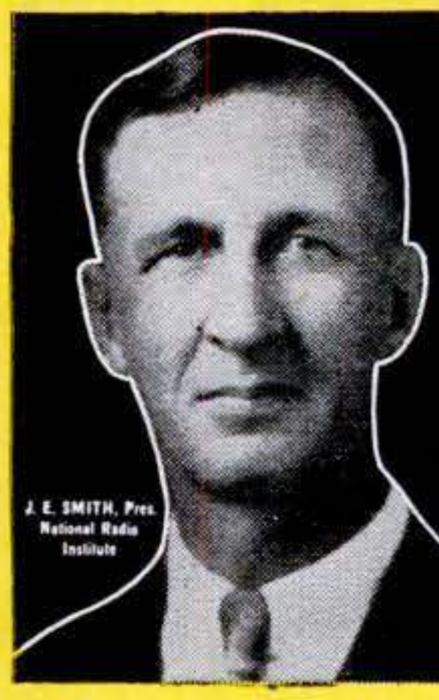

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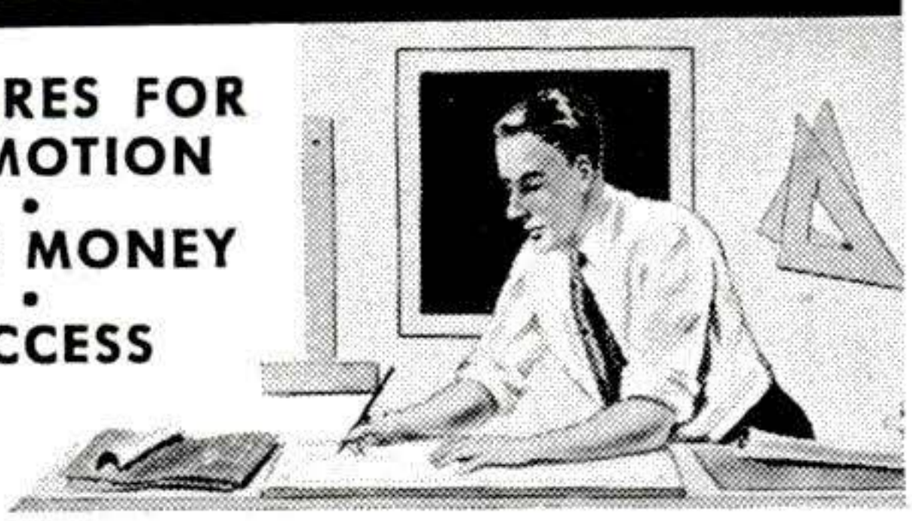

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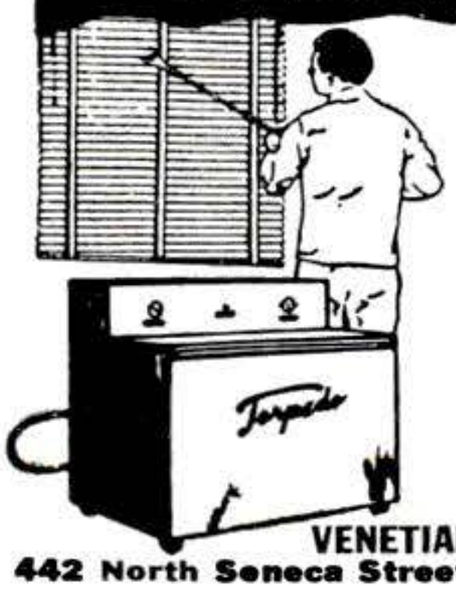

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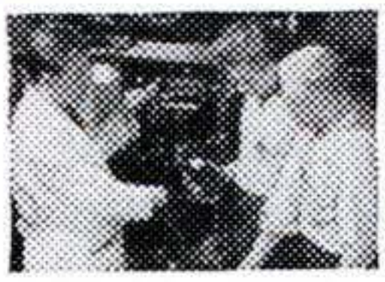

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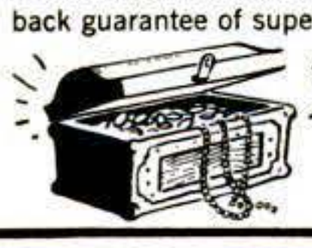

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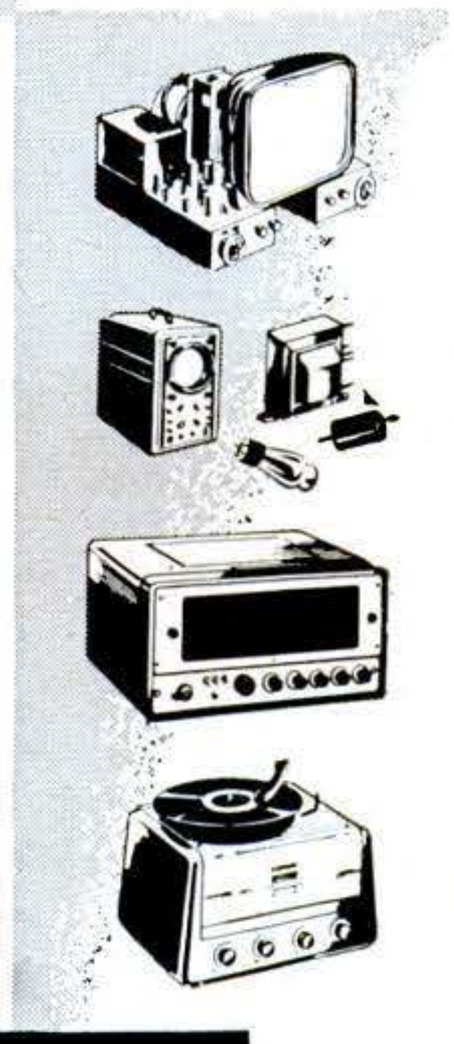

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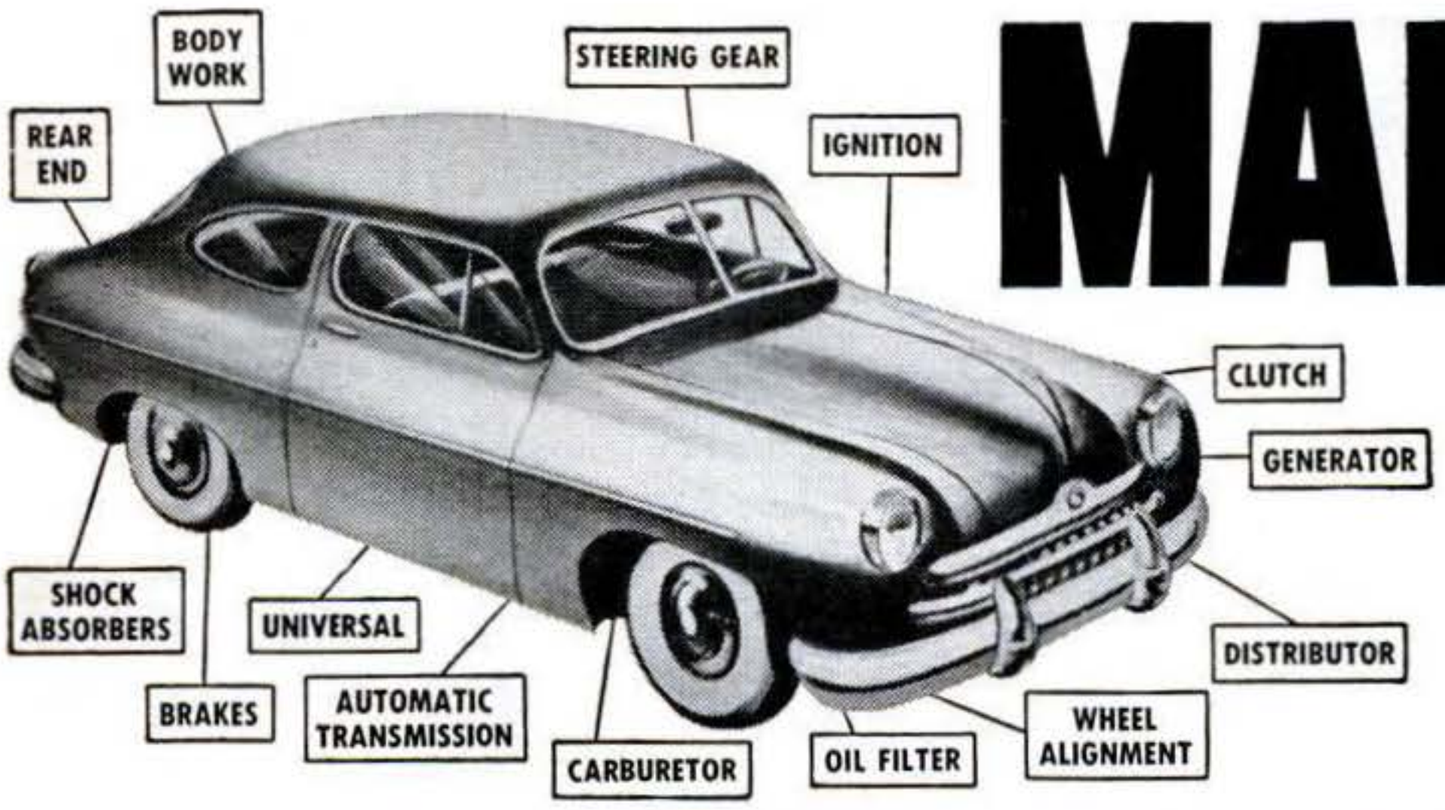

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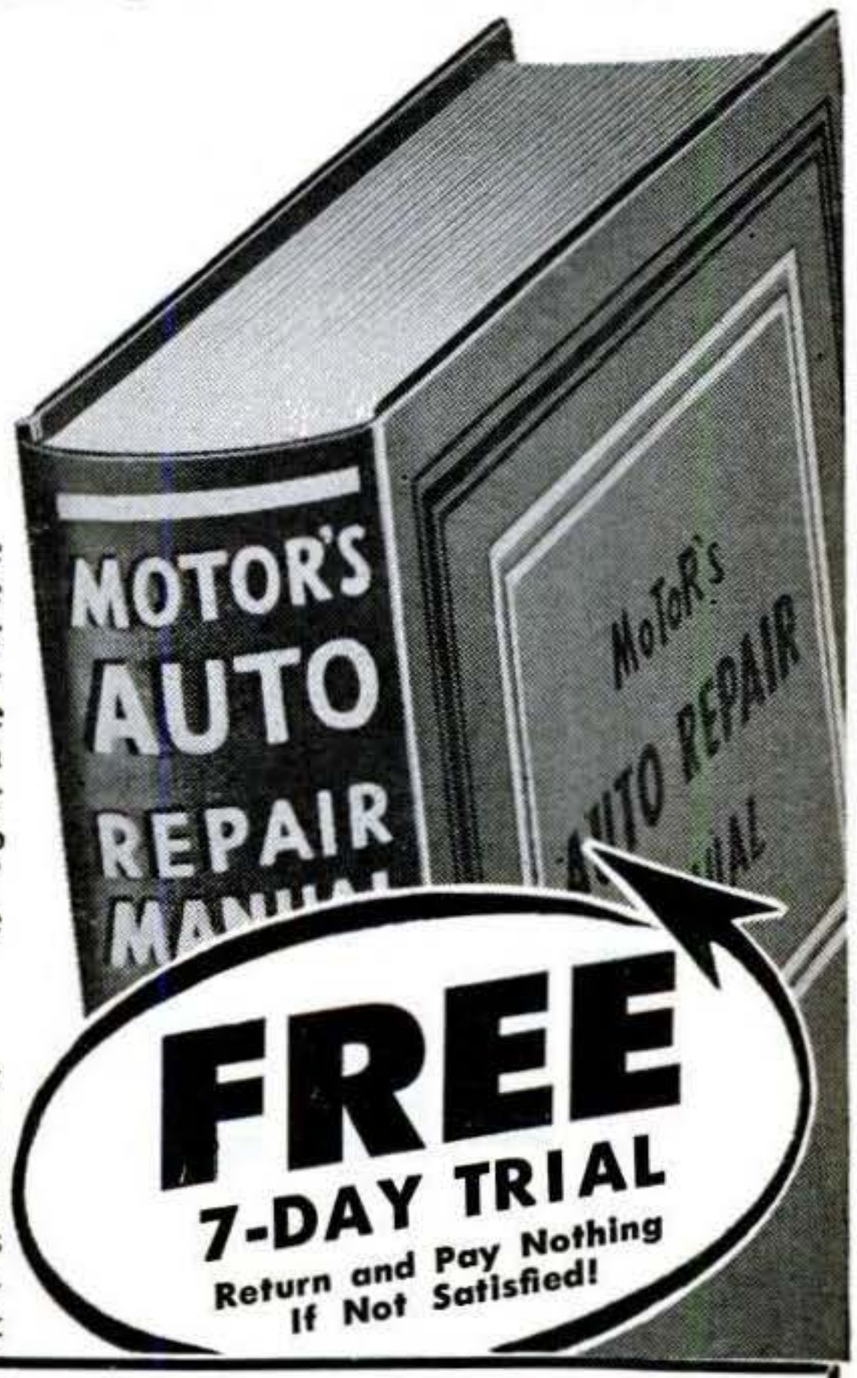

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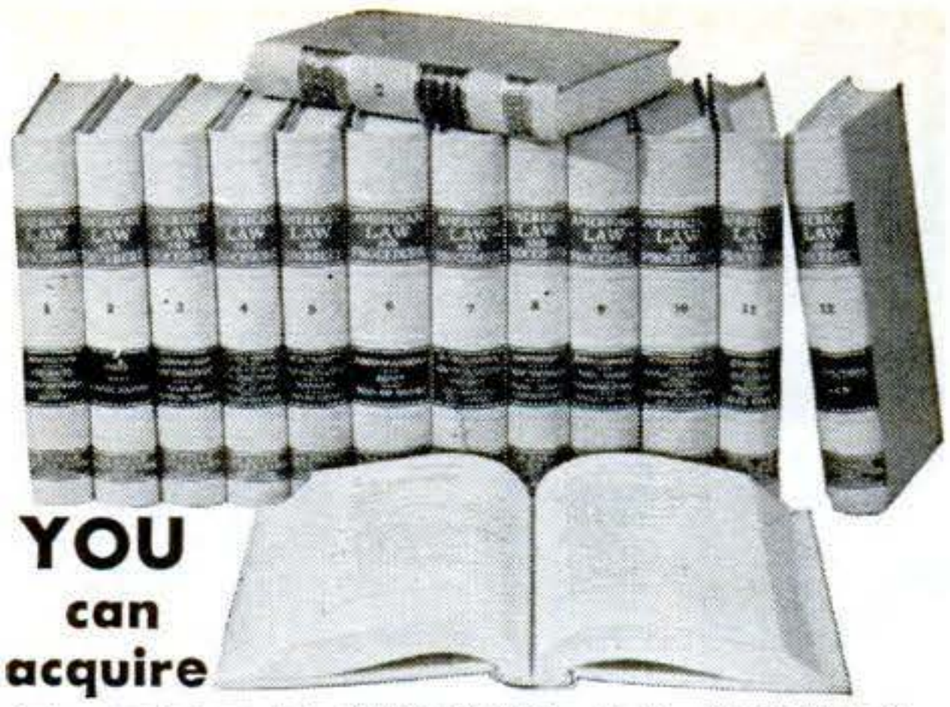

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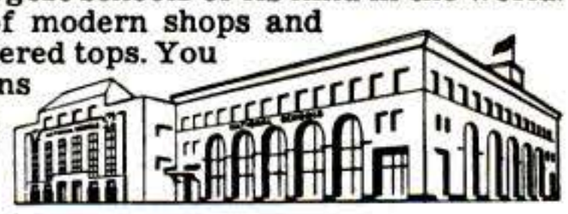

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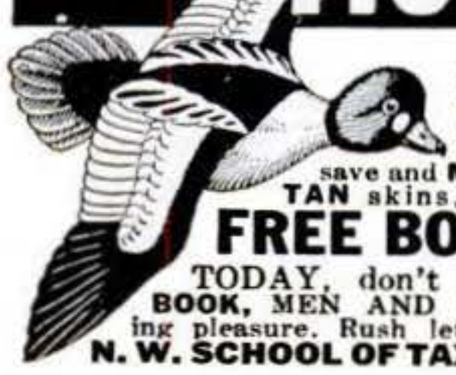

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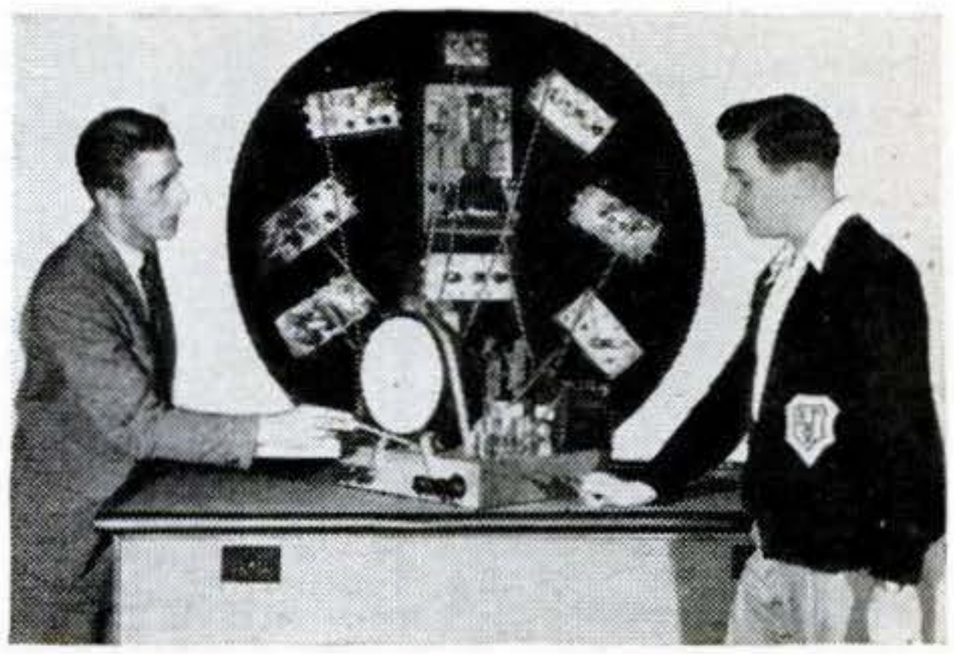

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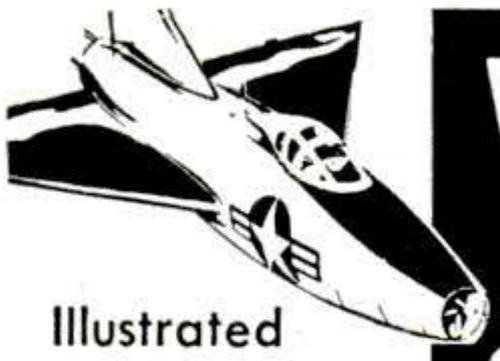

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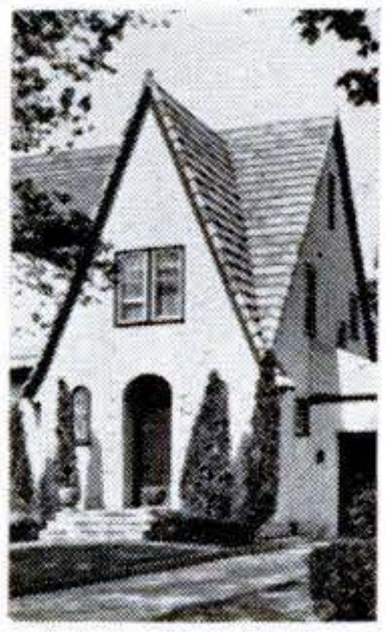

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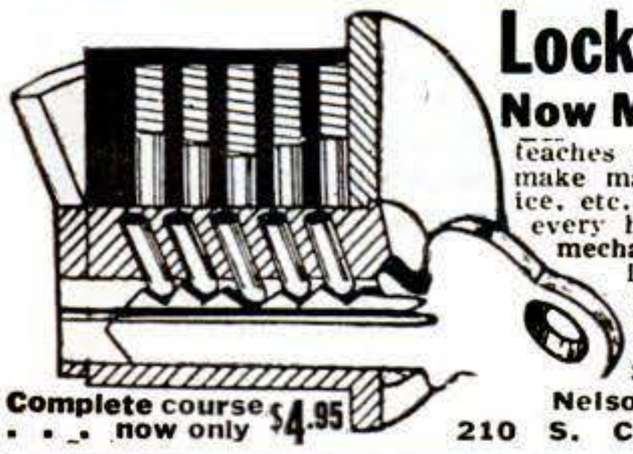

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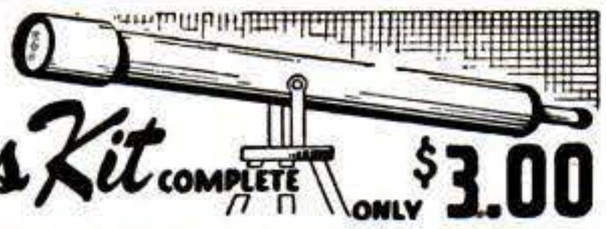

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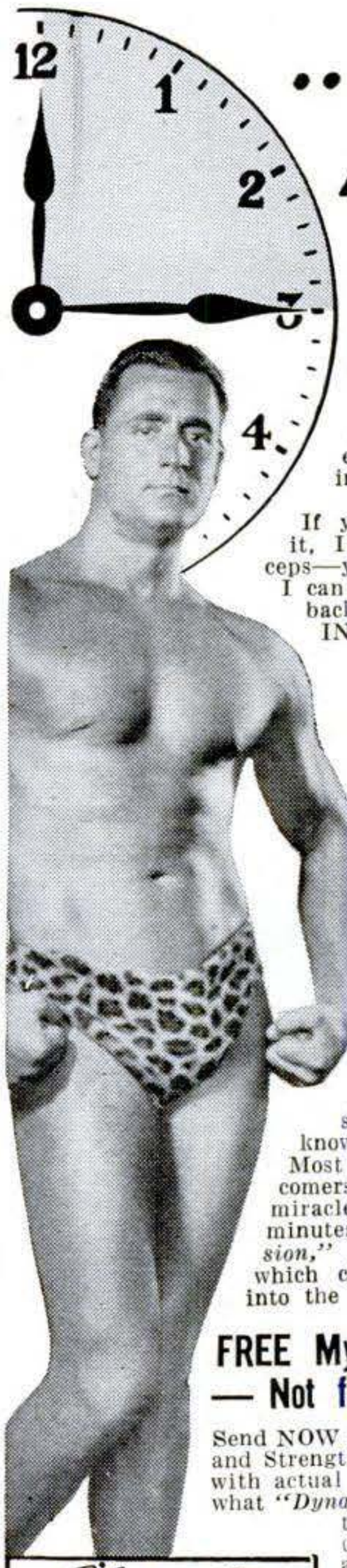

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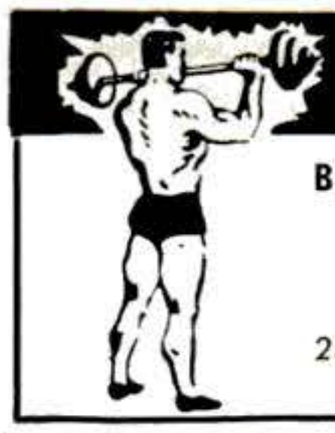

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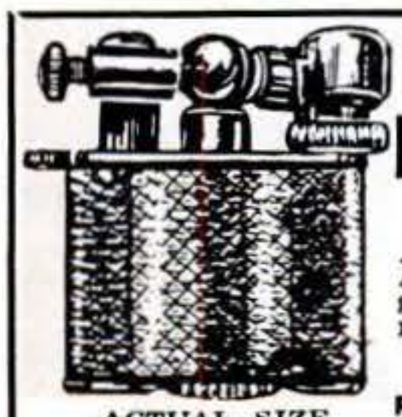

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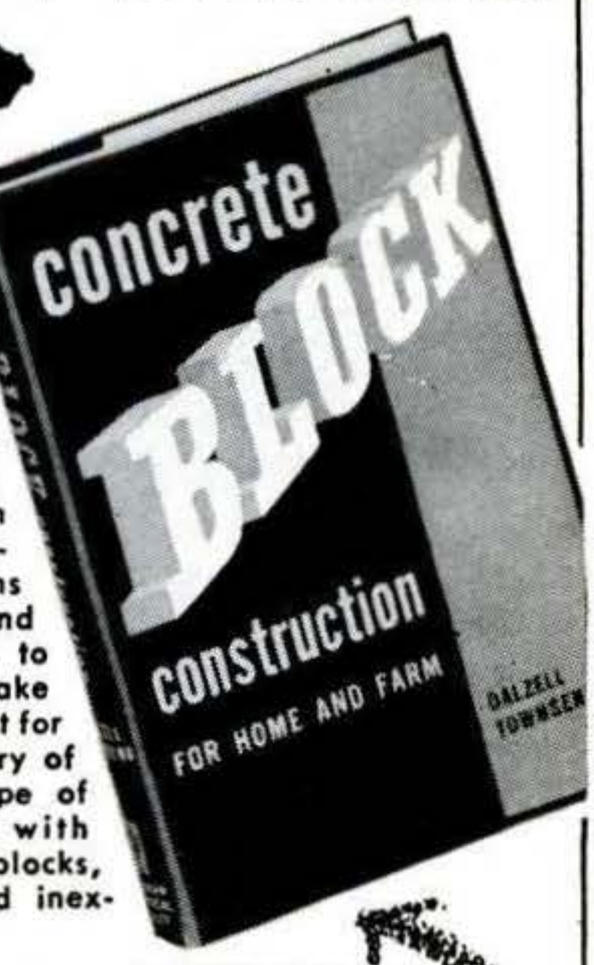

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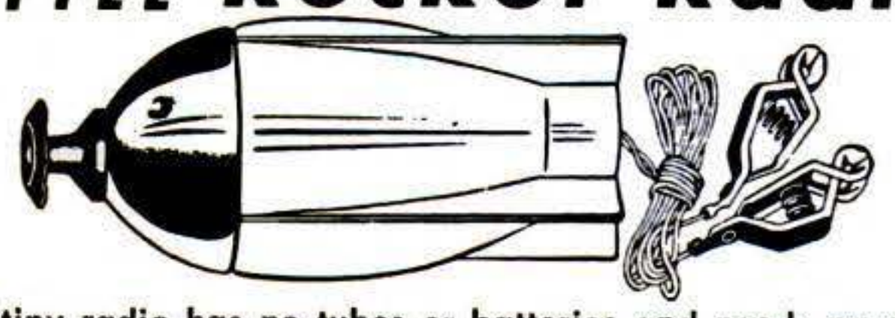

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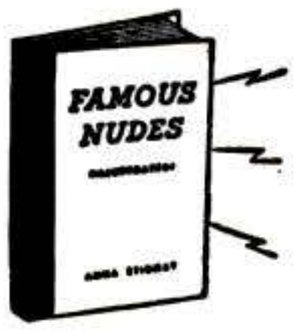

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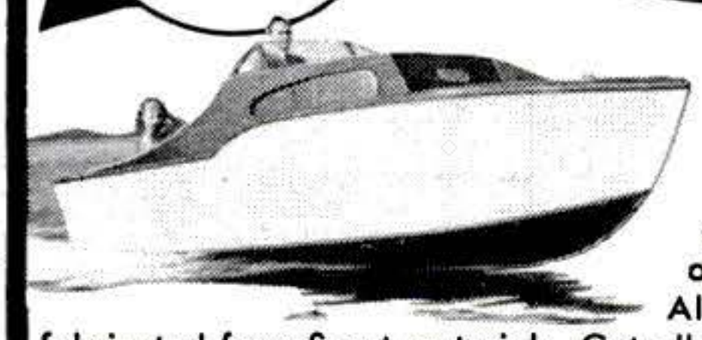

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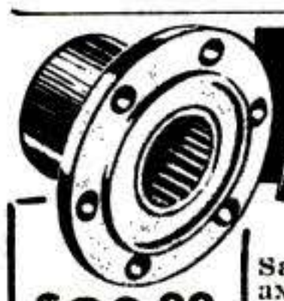

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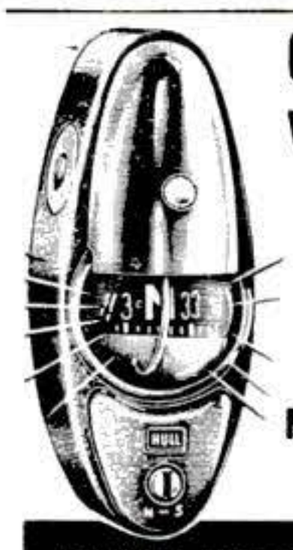

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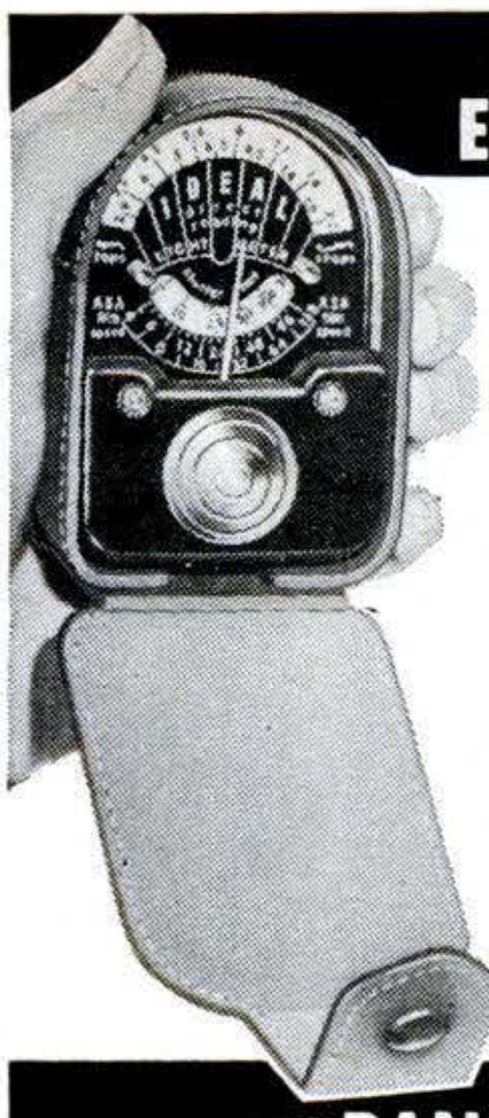

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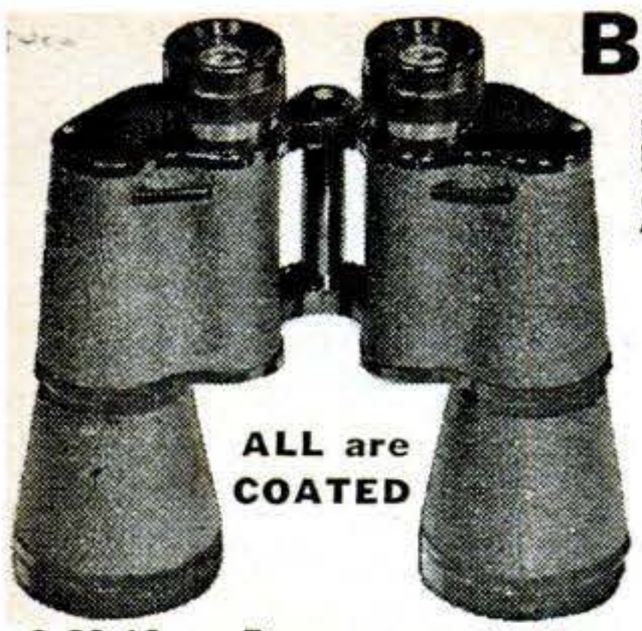

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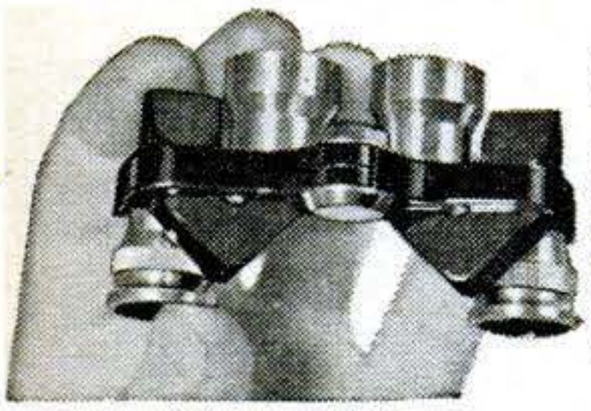

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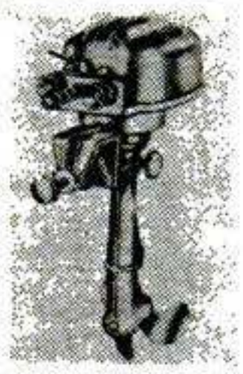

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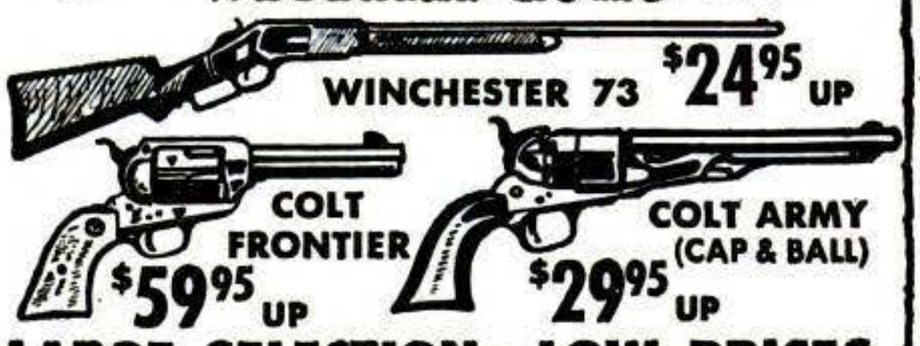

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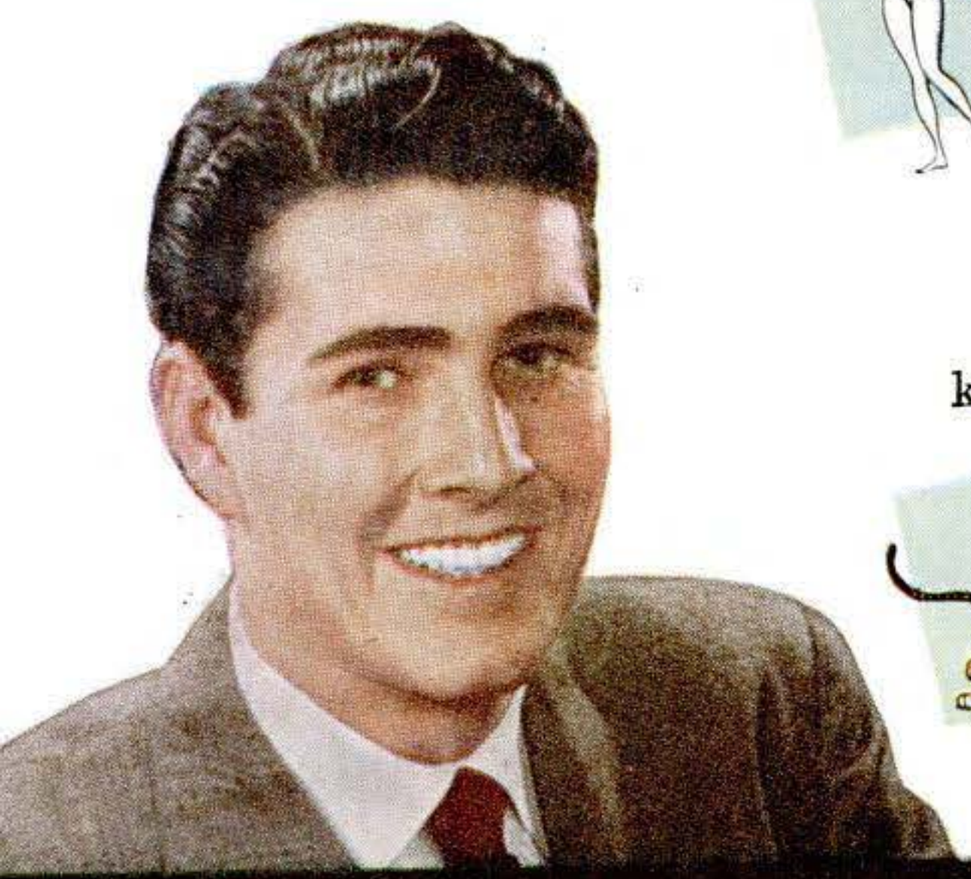

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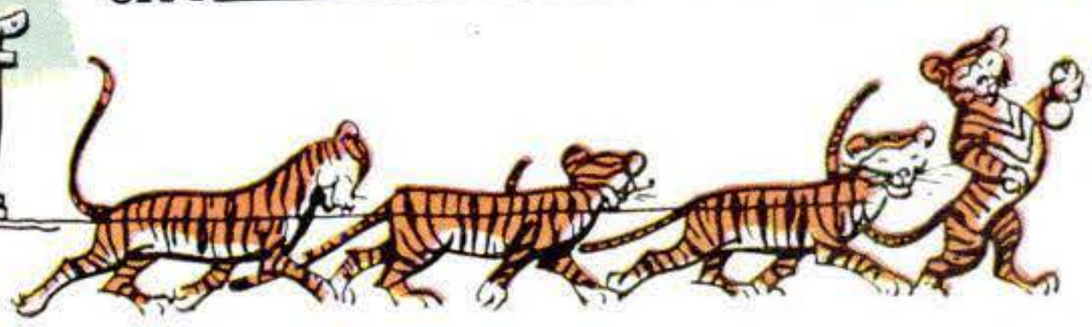

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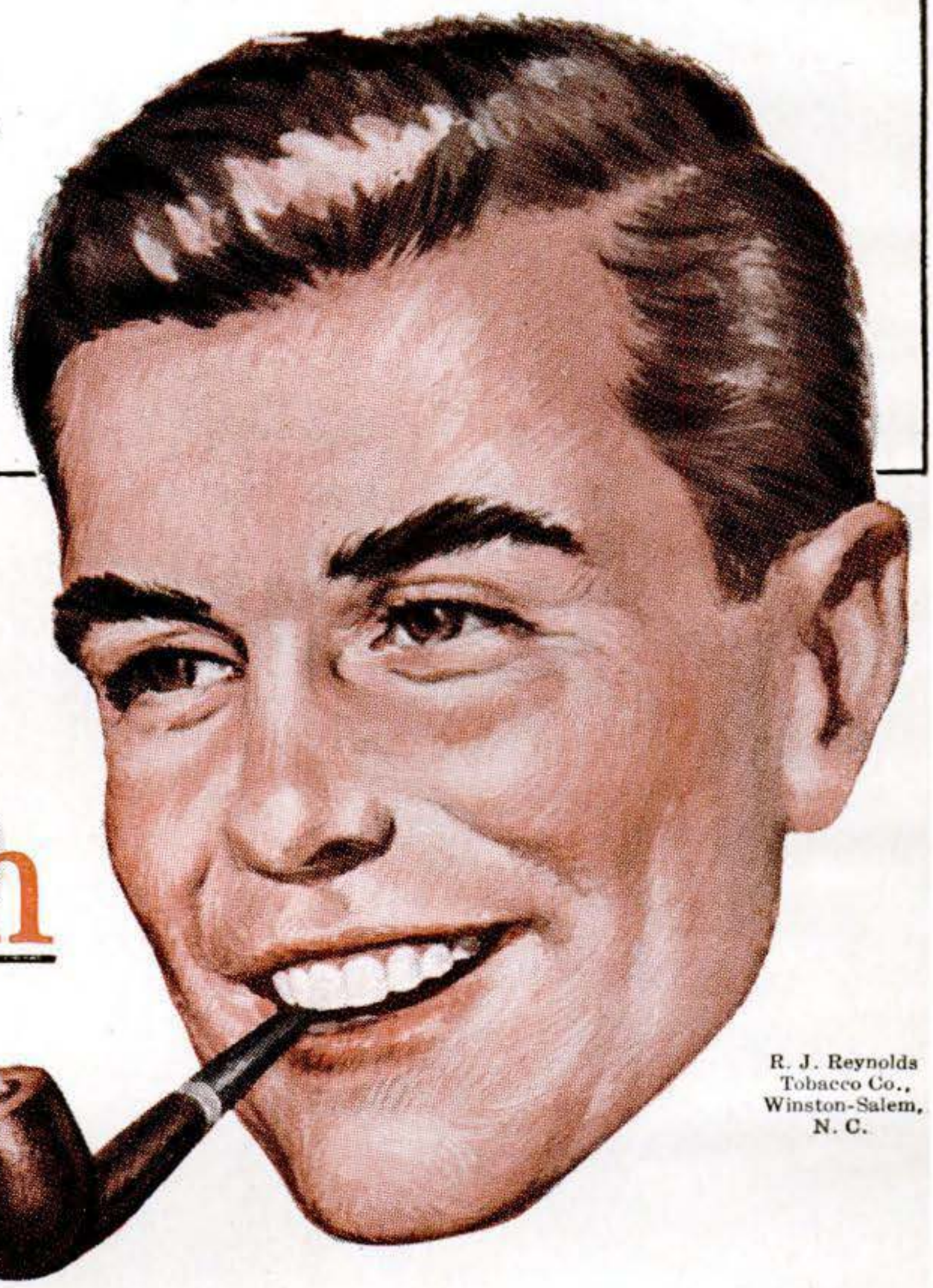

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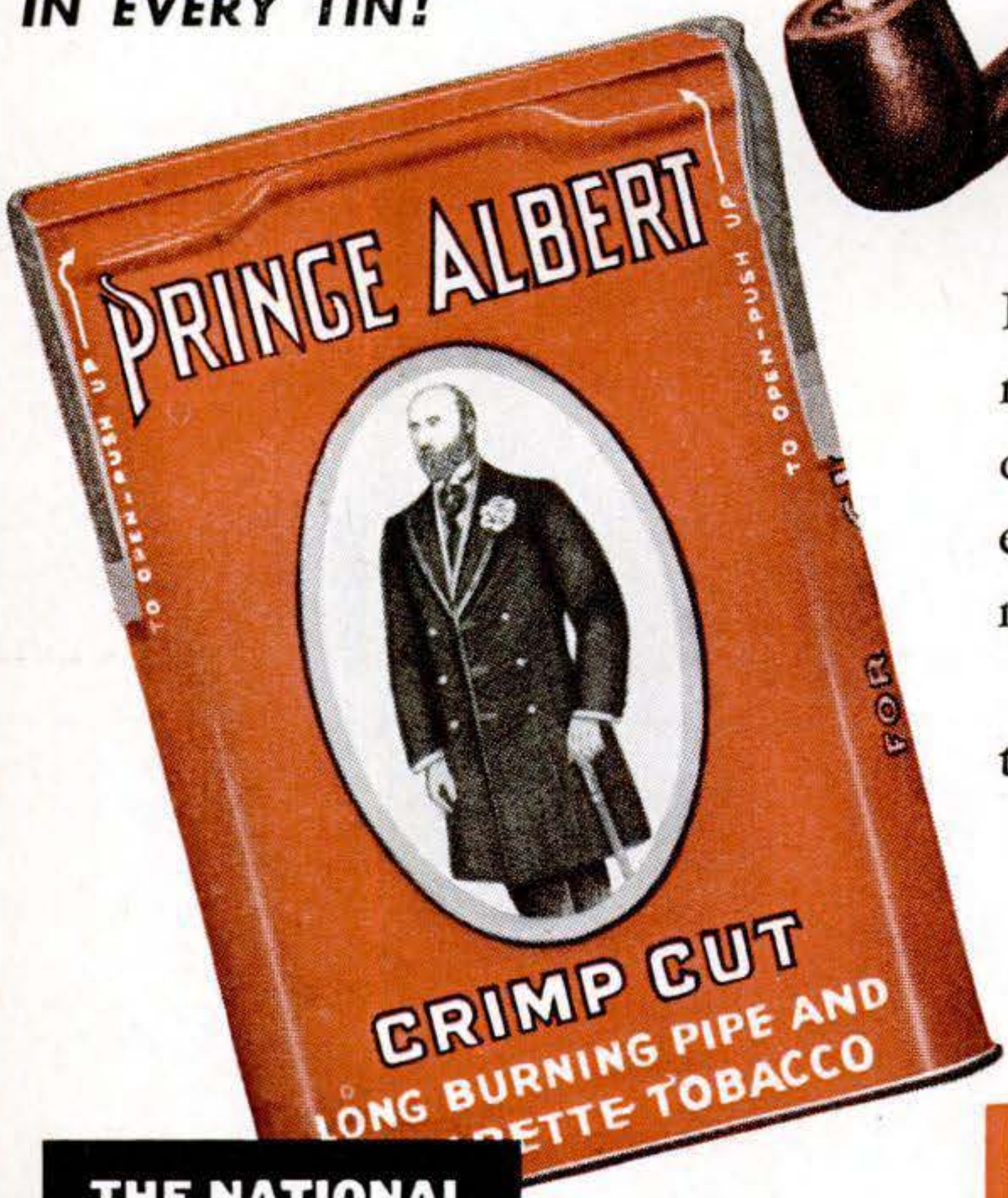

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Triangles to Stop the Big Bombers

Fast, agile delta-wing fighters are our ace in the hole against the atom-bomb carriers.

By Andrew R. Boone

KOREA has proved that we need faster, more maneuverable, more deadly fighters and interceptors. They can't be just as good as the enemy's if we want control of the air. And control of the air is something you either have or you don't have. We have not had it in Korea. We must have it here at home to parry any thrust of enemy jet bombers *before* they can lay their A-bomb eggs on our cities.

Once jet power promised to give it to us. But jets weren't enough. Then came the swept wing of planes like the F-86 Sabrejet. They did better along Mig Alley.

Now we have swept back the wings even more and are building flying triangles.

Farthest along of these still-experimental planes is Convair's XF-92A, pictured above. Resembling a child's schoolroom paper dart in shape, its wings are swept back 60 degrees along the leading edge, forming a triangle with equal sides. (Such a triangle also forms the Greek letter delta, hence the

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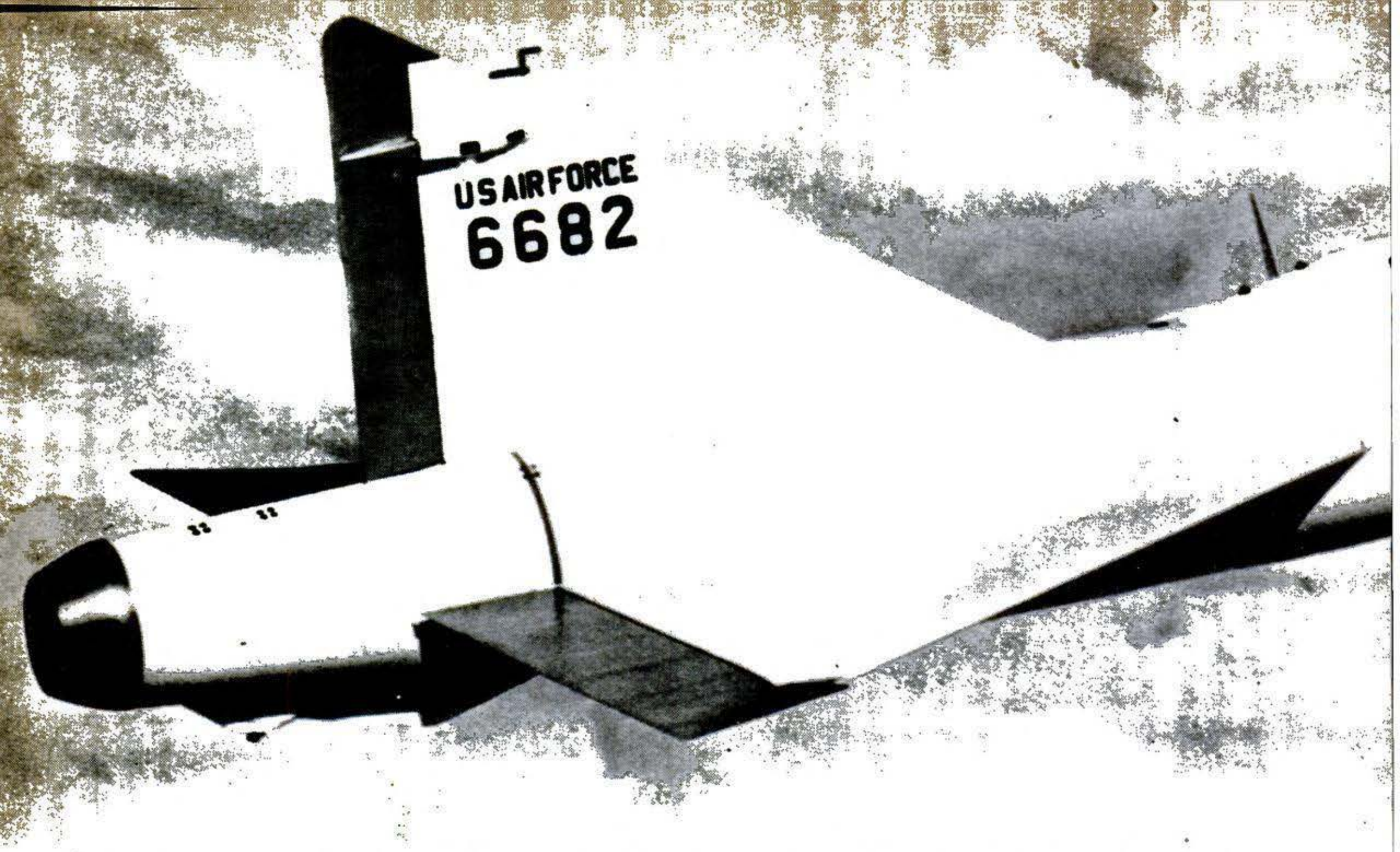
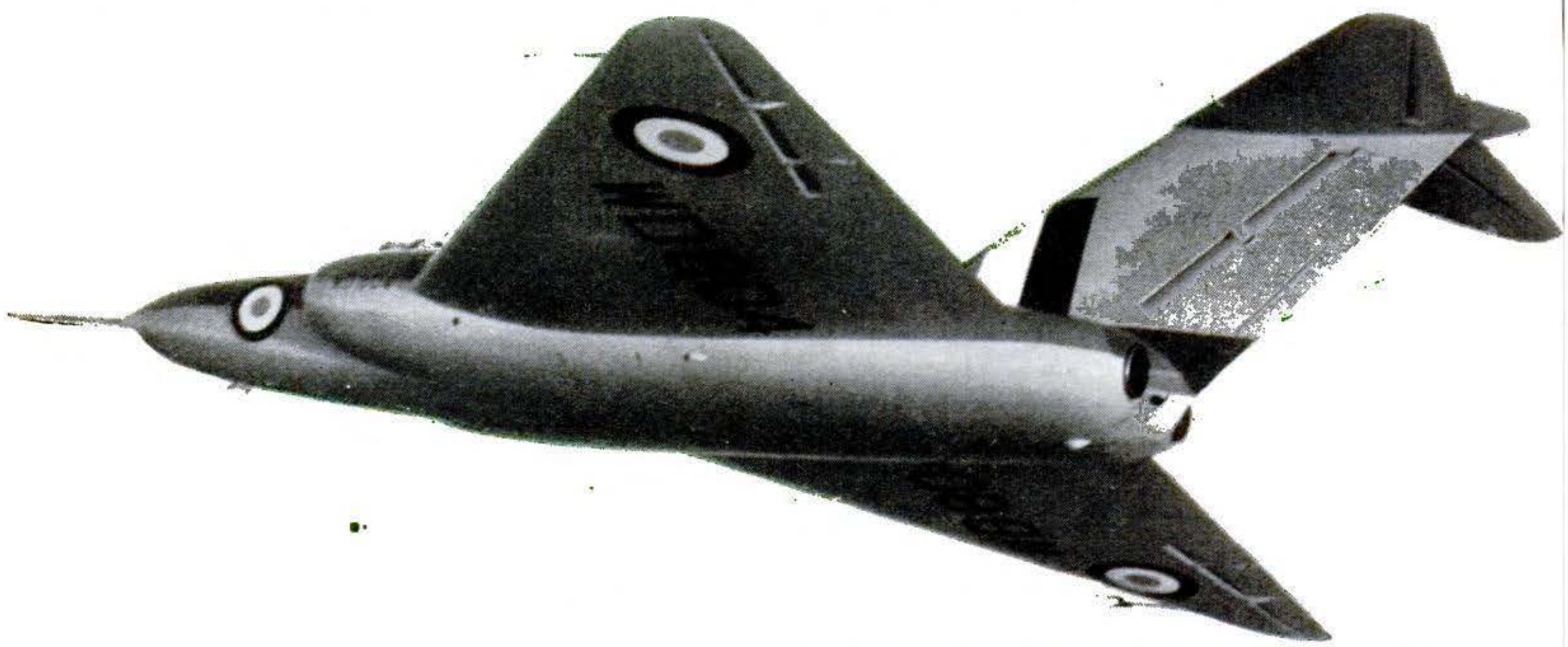


Delta wing in flight above is Convair XF-92A. It has afterburner that adds considerable thrust

name "delta wing.") But why are we building a flying triangle?

● It flies faster with equal power because there is less aerodynamic drag. Then there's another factor. As a plane flies fast, it encounters a shock wave that forms a narrowing cone. The delta wing, because it can be swept farther back, fits into this cone much as a finger fits into a glove. The XF-92 already has flown faster than sound, and speeds of 1,500 miles an hour are predicted by some experts for this type of aircraft.

One disadvantage of the delta wing is that it has high drag at low speeds. The more powerful jet engines we are producing will take care of this. And there is compensation and more in its efficiency at speeds approaching sound. It really pays off at the



BRITISH are in the delta-wing act, too. Of twin-engined Gloster GA-5 (above), they say: "It is better qualified than any other aircraft to destroy atom bombers from any country..."

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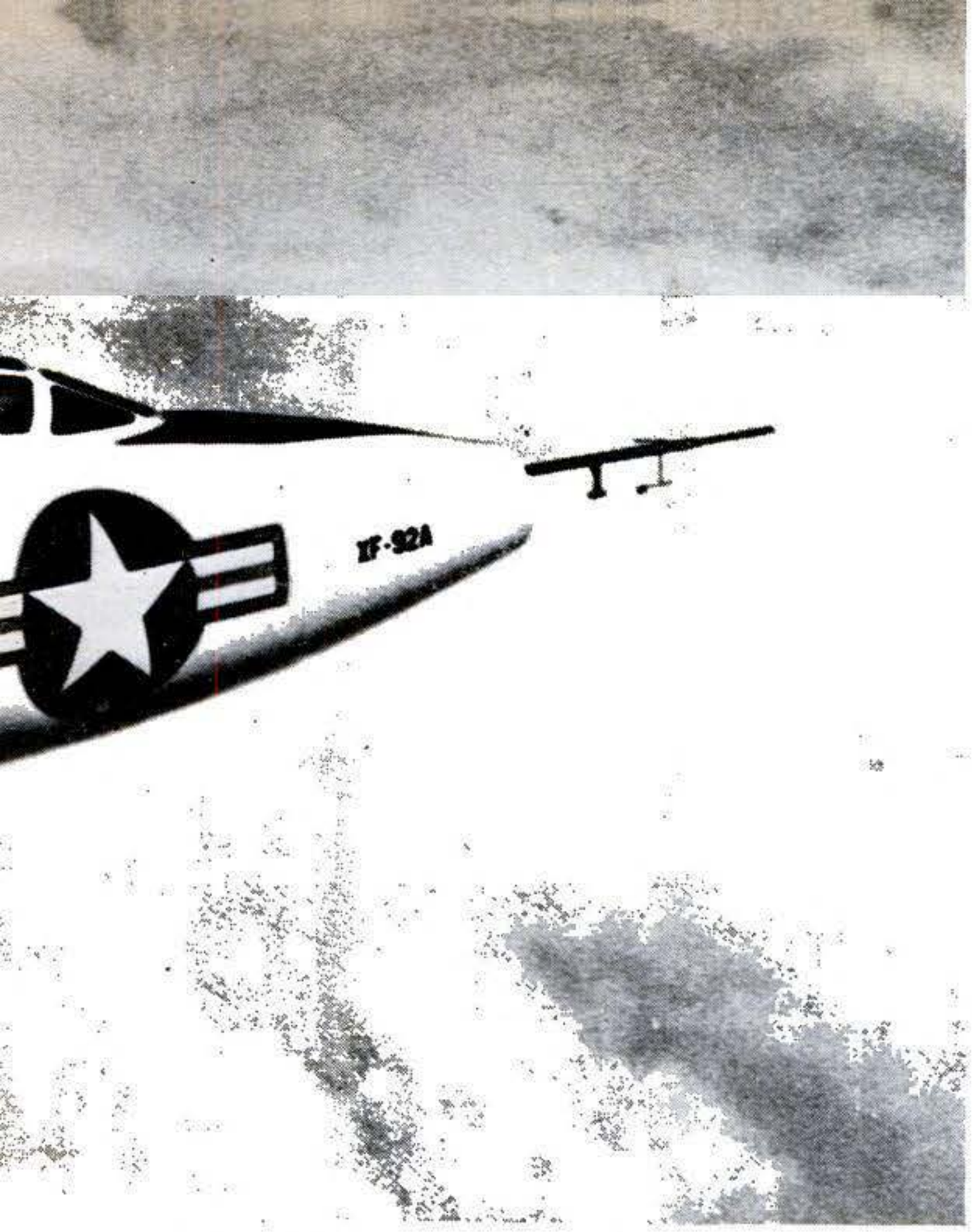


to the triangle's Allison turbojet engine.

supersonic speeds at which it will fight. ● Its maneuverability, especially at high altitudes, makes all Air Force pilots who have checked out in the F-92 triangle-happy. Says Maj. Charles E. (Chuck) Yeager, "The delta can outturn practically any airplane *at any altitude*." Chuck should know. He pioneered faster-than-sound flight and has flown them all.

● Flight stability is another virtue of the delta form. That means a better gun platform, which means deadlier accuracy in throwing bullets and rockets at an enemy.

Outstanding in speed, maneuverability and destructive power, the dartlike shape has still more on the ball. It handles as easily as its more conventional jet brothers. It cannot be stalled. It makes the once-dreaded transition from subsonic to supersonic flight without buffeting or control conniptions.

Its larger wing area provides increased lift and more space for fuel without resorting to external tanks that cut down speed. And the elimination of a tail section makes for a simpler design, saving production time.

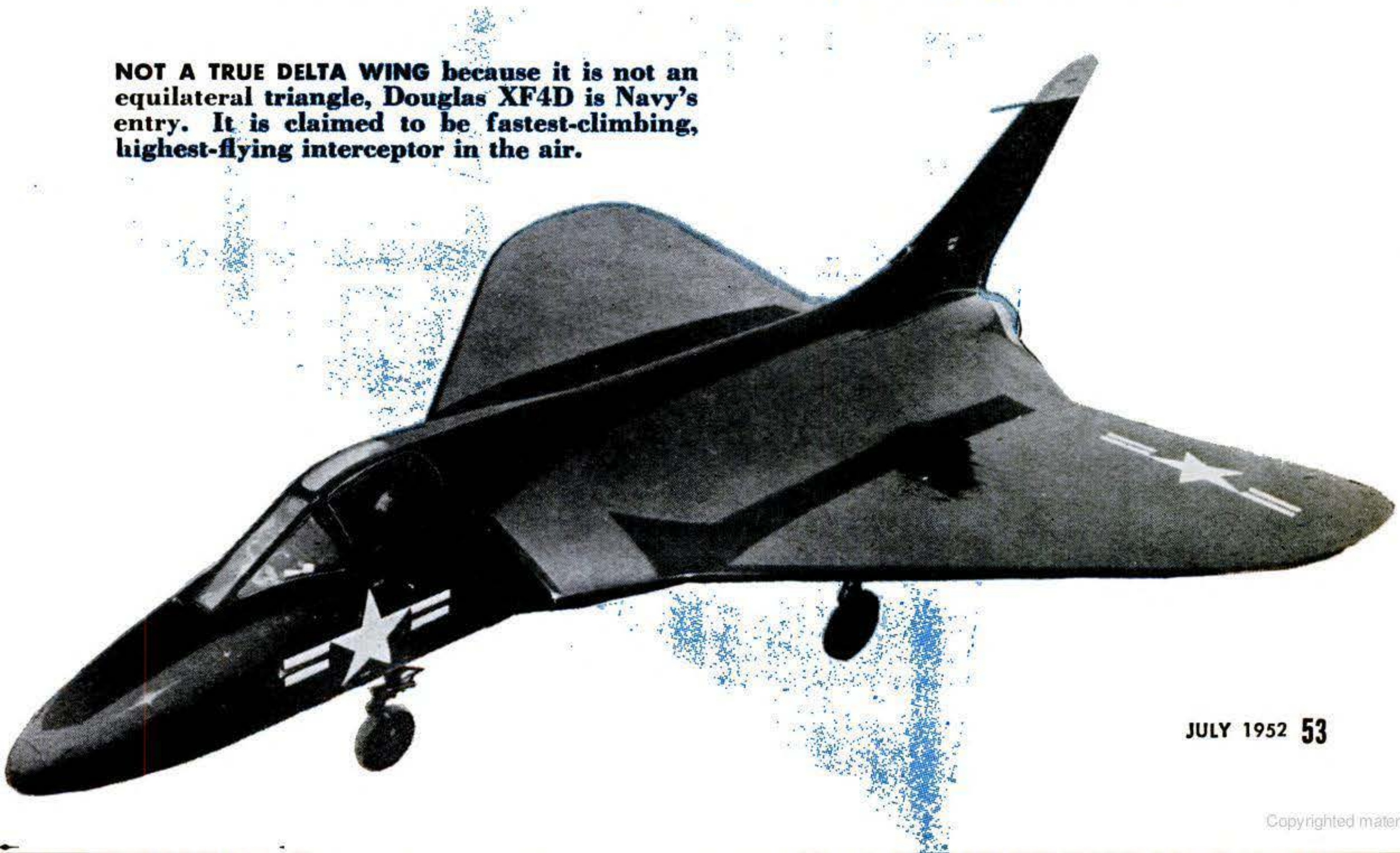
Contracts Have Been Signed

All these performance and design characteristics have been proved in extended flight tests of the F-92 over the California desert. As a result, both the Air Force and the Navy have been sold on the delta wing to the extent of ordering several air-frame manufacturers to design other flying triangles. They are on the secret list.

As for the XF-92A, it has just about done its job as a research model. It will be followed by the XF-102. A production contract has been awarded Convair, with expectations that the first Flying Triangles will see service with fighter squadrons in two years.

And a good thing. The Russians are reportedly developing a delta wing. END

NOT A TRUE DELTA WING because it is not an equilateral triangle, Douglas XF4D is Navy's entry. It is claimed to be fastest-climbing, highest-flying interceptor in the air.



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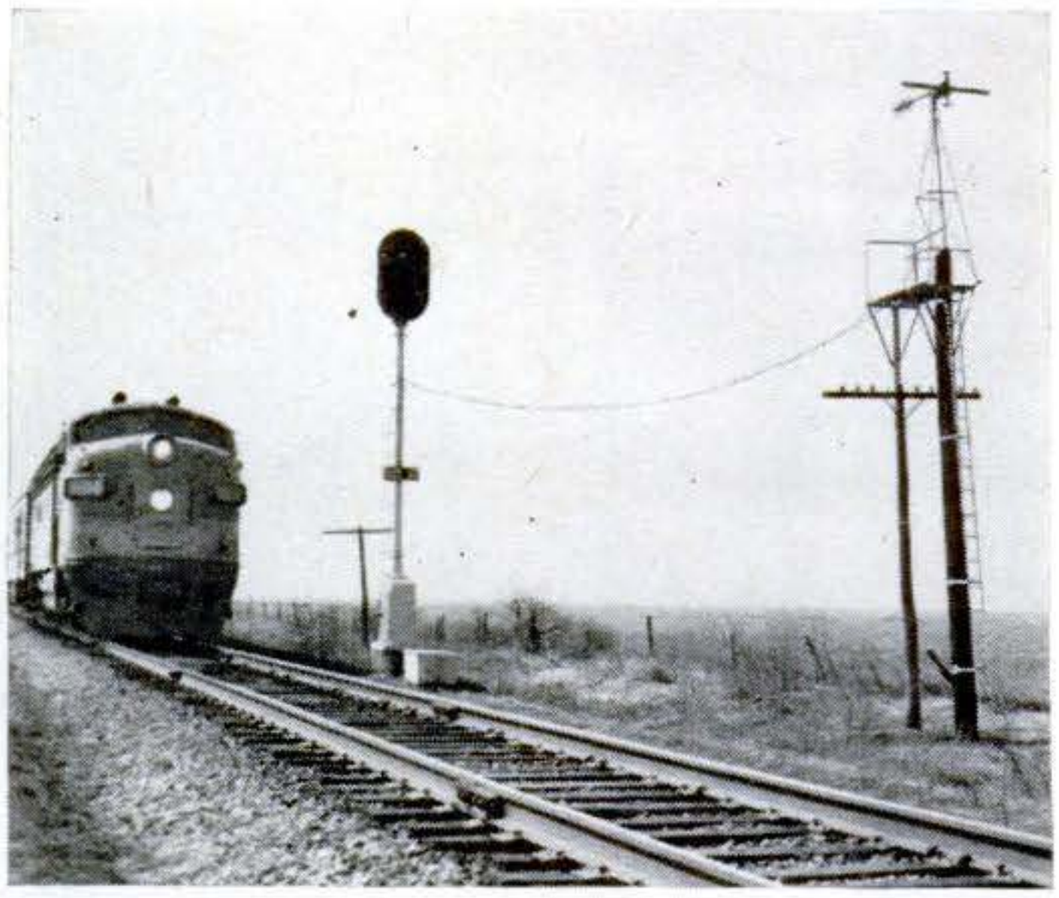
Phone Doesn't Ring—It Taps

A SOLDIER 'way out in front won't call down enemy fire when this new Army field phone "rings." It signals incoming calls with a tapping that sounds like a woodpecker. Adjustable for volume, the tapping can be heard more easily than a bell and twice as far, even in battle noise. The phone normally works on two flashlight batteries but will transmit five miles on just the power of the speaker's voice.

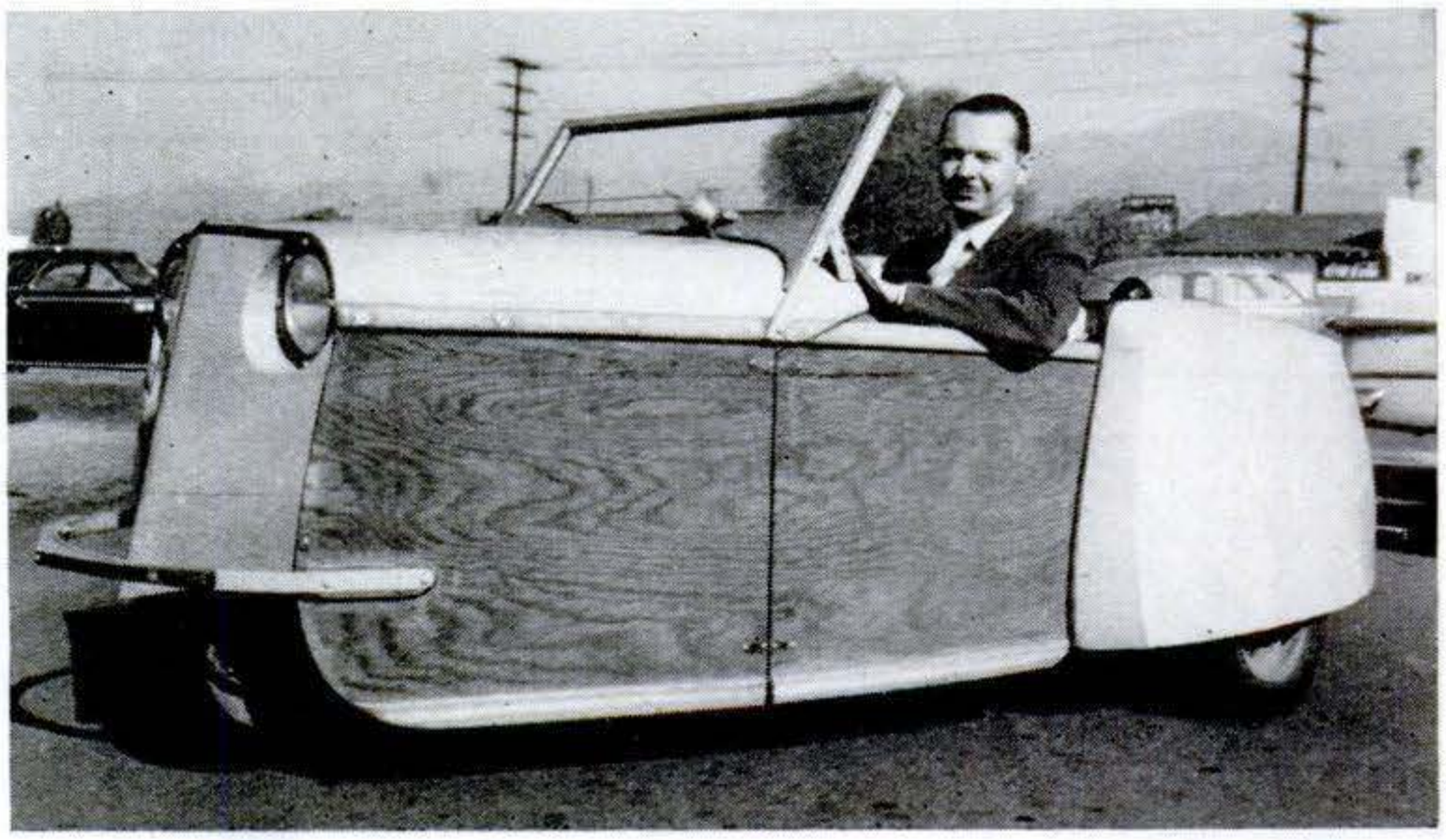


Windmill Power Operates Signal

A WINDMILL generator, atop the nearest pole in the photo above, charges a storage battery that works a signal beyond. This dispenses with a lengthy power line for the purpose. The idea helped to save 20 miles of electric wire in installing a pair of signals on the Chicago and Eastern Illinois Railroad, at a junction 90 miles south of Chicago, and eliminated trouble with long overhead wiring from wind and sleet.

"Fill 'Er Up" Puts 1½ Gallons of Gas in Featherweight Car

THIS homemade three-wheel car cost Walter H. Korff of Burbank, Calif., just $250 to build. Its plywood body has room for the driver and one passenger. The midget vehicle weighs only 684 pounds and consumes so little fuel that a 1½-gallon gasoline tank is big enough. Capable of 50 m.p.h., it has an 8¼-hp. engine.



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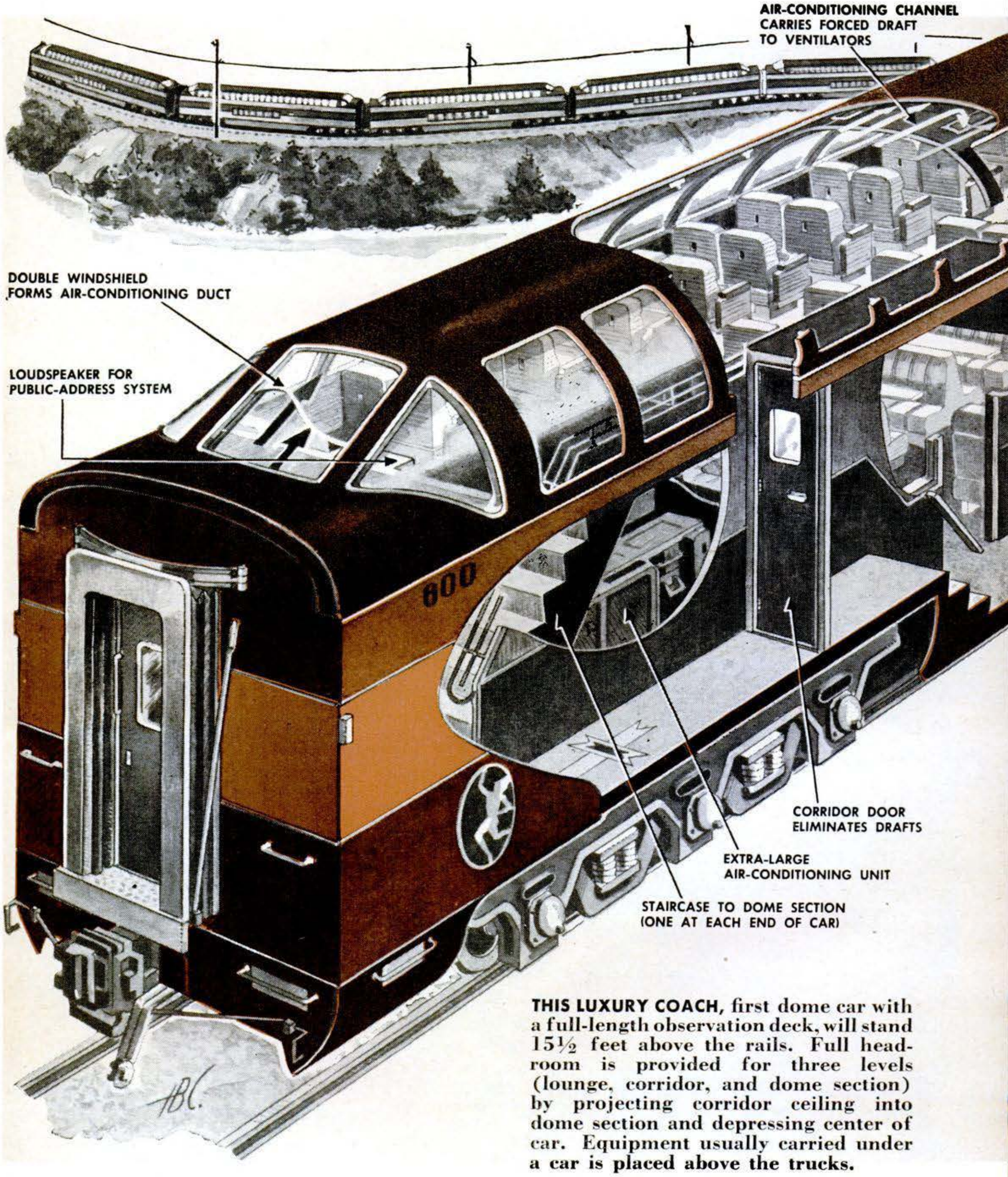
Gun-Toting Car Goes 70 M.P.H. Forward or Back

TWO drivers face in opposite directions in this new French armored car. A flick of a lever transfers control from one to the other, enabling the 13-ton machine to dash forward (below) or backward (above) without turning. Designed for reconnaissance, the 70-m.p.h. car is armed with a 75-mm. cannon and three machine guns.

Super Dome Cars

Will Carry 68 Upstairs



THIS LUXURY COACH, first dome car with a full-length observation deck, will stand 15½ feet above the rails. Full headroom is provided for three levels (lounge, corridor, and dome section) by projecting corridor ceiling into dome section and depressing center of car. Equipment usually carried under a car is placed above the trucks.

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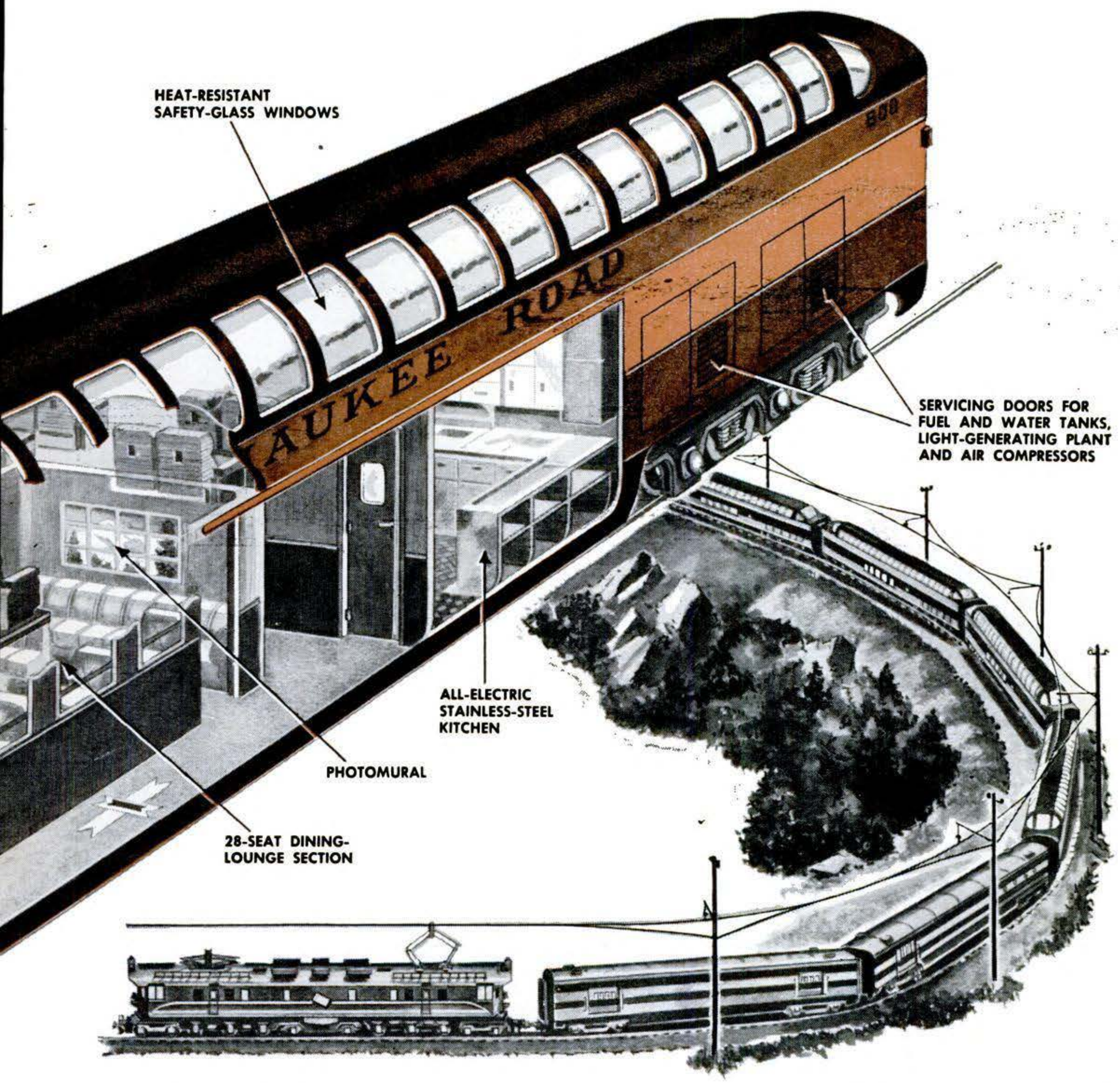

By Henry B. Comstock

RAILROAD travelers like watching scenery from the glass-roofed "dome" cars too much—there isn't enough room upstairs for all who want to sit there. Now a new model will solve this problem with a full-length observation deck providing a seat-with-a-view for every passenger. Downstairs, a luxurious diner-lounge will be served by an all-electric kitchen. Pullman-Standard is making 10 of the cars for the Milwaukee Road.

To beat the summertime heat in the huge double-glazed dome section, an air-conditioning unit twice the size of standard car-cooling plants is being placed in one end section. Cold air will be blasted upward between two panes of glass forming a double windshield at one end of the car, then carried through a channel in the roof. Outlet ports deliver a controlled supply at intervals along the 73-foot glass top.

Sky-gazers will have little to fear from falling rocks and ultraviolet rays. The three-by-five-foot, curved dome windows are to be made of half-inch-thick, tinted safety glass. Through them, travelers will be treated to a bigger and better view of the scenery—the Bitter Roots, Rockies and Cascades from the Olympian Hiawatha, to which six of these cars will be assigned; and the upper Mississippi Valley from the Morning and Afternoon Hiawathas, each of which will rate two cars. Loudspeakers will announce points of interest. END

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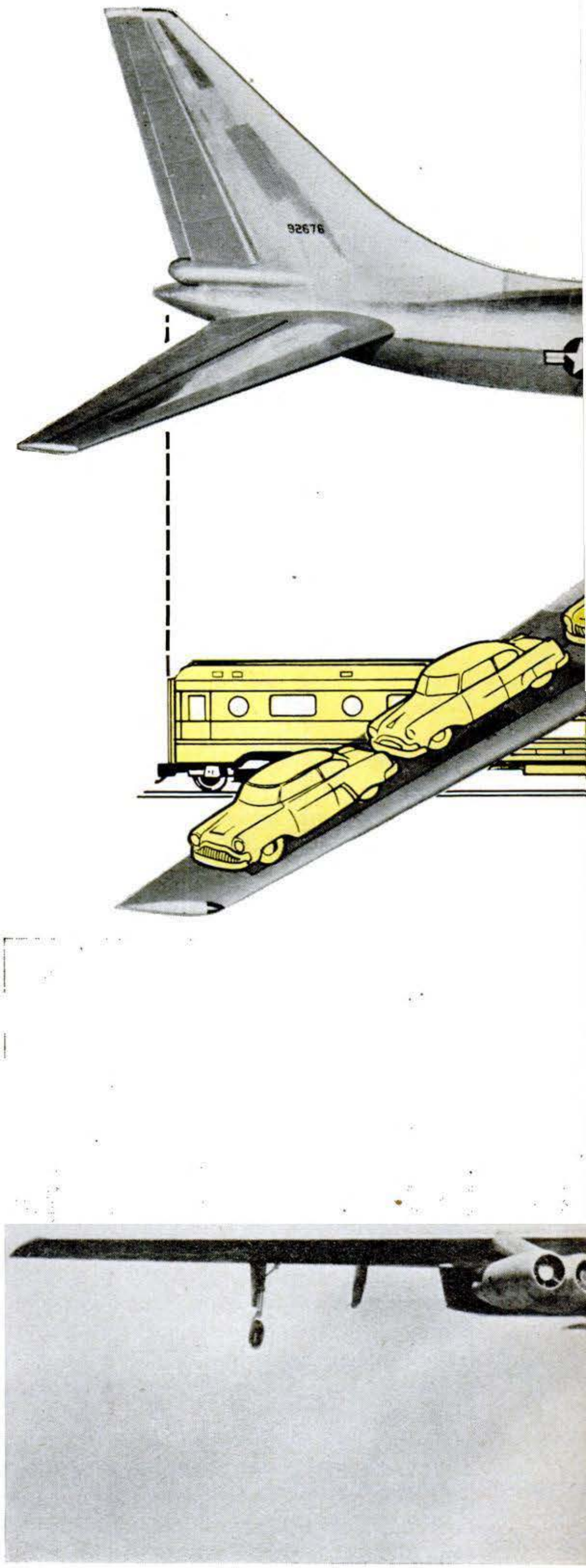
U.S. Unwraps Jet Giants



THEY are big—these two new, jet-flown Air Force weapons designed for global, atomic war. Five automobiles could be parked, with room to spare, on each wing of the Convair YB-60. The world's largest bomber, it's as long as two railroad coaches. For a more personal comparison of the bomber's size, study the three men who are standing near the nose at far right. They're not midgets.

The Boeing XB-52 Stratofort (lower photo) is somewhat smaller but still impressive. Each plane has eight of our latest turbojet engines. Both planes are powerful and can climb rapidly to an altitude of 40,000 feet. They've got global range—10,000 miles is estimated. And they're fast—perhaps exceeding the speed of the six-jet B-47, up to now the world's fastest bomber, which has crossed the continent at an average speed of 607 miles an hour. And they might carry their own fighter escort, released in flight the way the F-84 Thunderjet was recently launched experimentally from the belly of a piston-jet B-36, our biggest operational bomber.

When they join our Air Force—production has been ordered on the B-52—these two swept-wing giants are expected to give us a decided advantage over the Russians in strategic bombing. Latest intelligence credits the Soviet Union with only one long-range bomber—the piston-engined Tu-4, a copy of our wartime B-29 Superfortress. In jets, the Russians have a twin-engine medium, the Tu-10. But neither has the necessary long range combined with speed to evade or outdistance interceptor jets of a defending nation.

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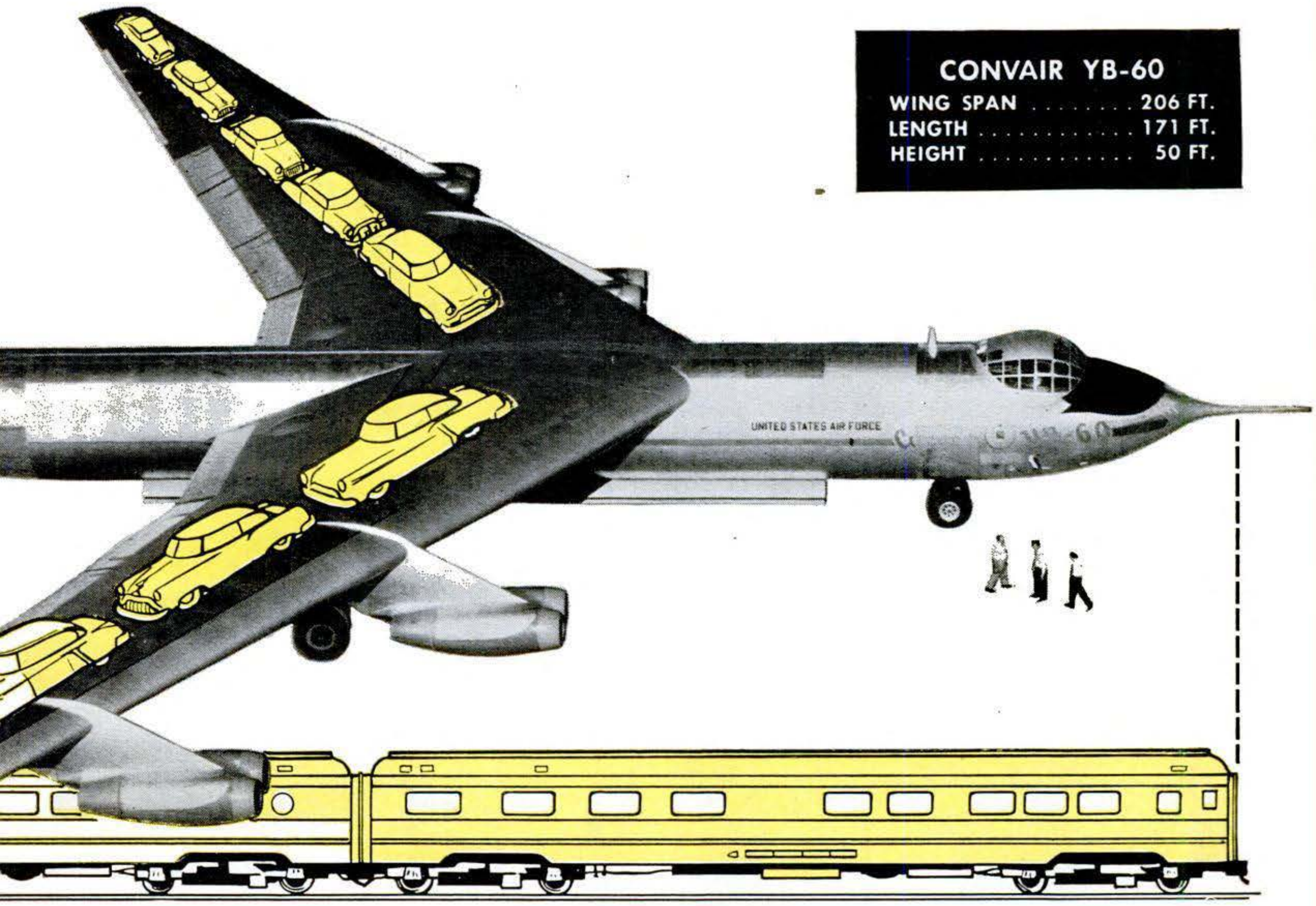
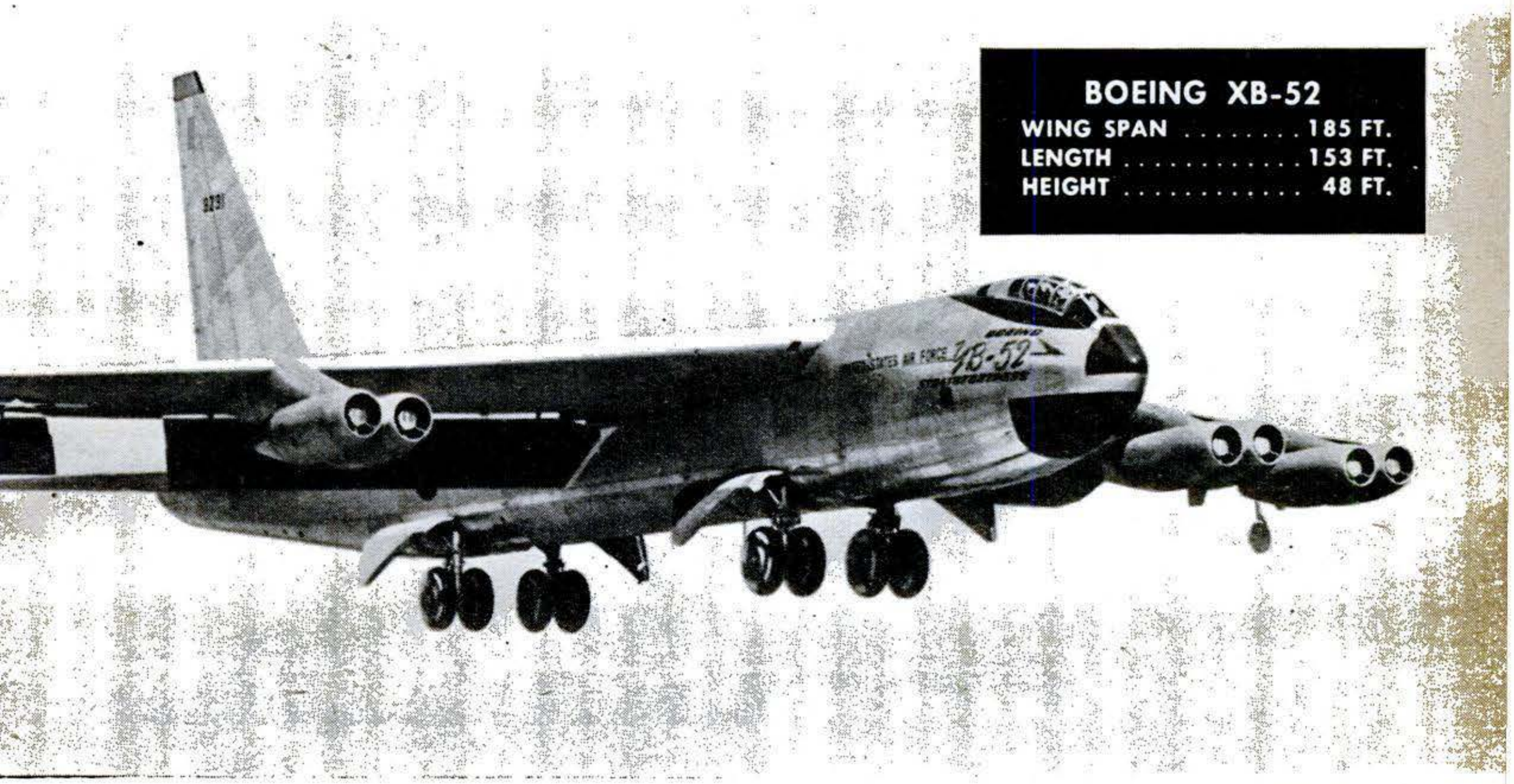


CONVAIR YB-60

WING SPAN	206 FT.
LENGTH	171 FT.
HEIGHT	50 FT.



BOEING XB-52

WING SPAN	185 FT.
LENGTH	153 FT.
HEIGHT	48 FT.

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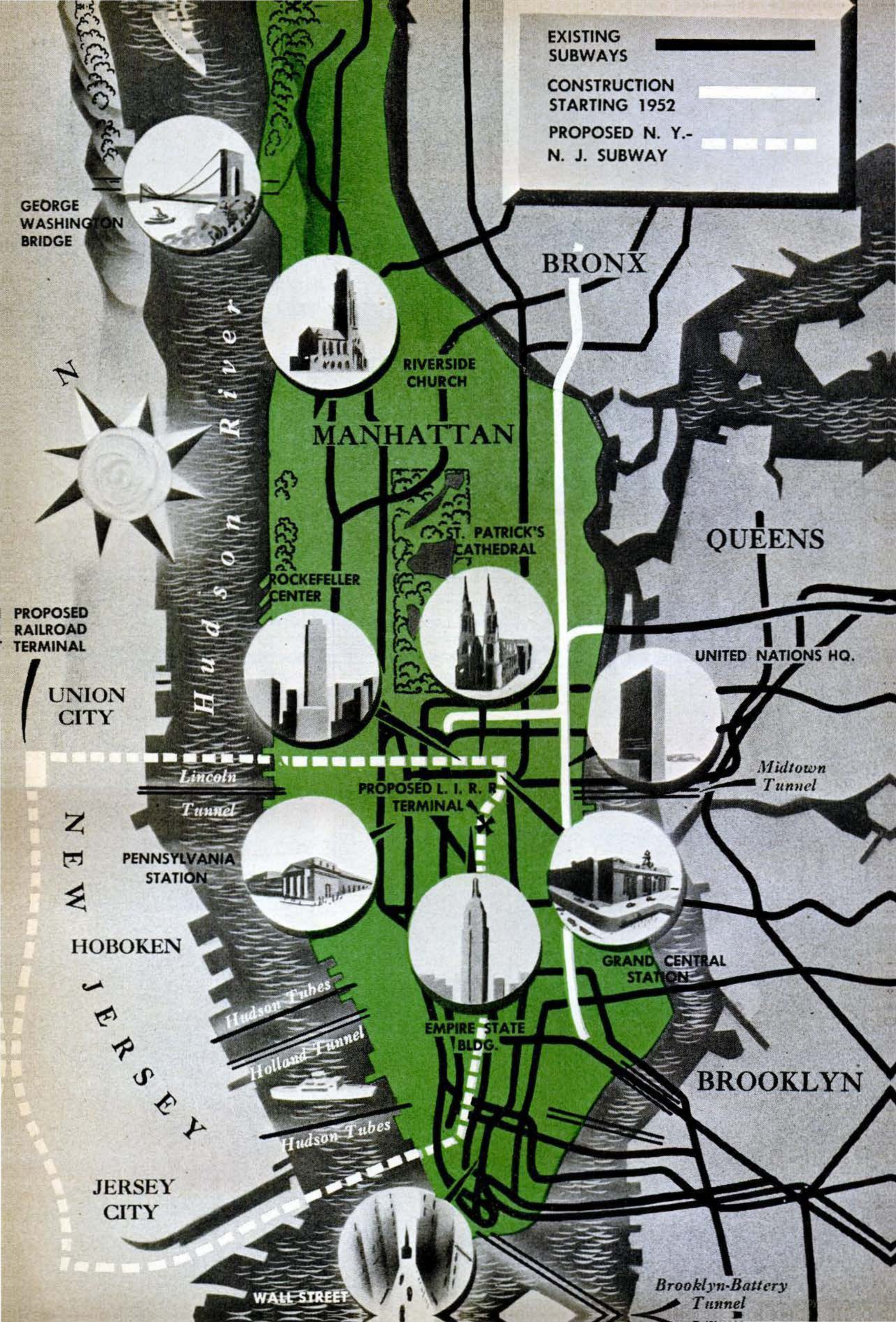
EXISTING SUBWAYS
CONSTRUCTION STARTING 1952
PROPOSED N. Y.-N. J. SUBWAY
GEORGE WASHINGTON BRIDGE
BRONX
RIVERSIDE CHURCH
MANHATTAN
Hudson River
ST. PATRICK'S CATHEDRAL
ROCKEFELLER CENTER
QUEENS
PROPOSED RAILROAD TERMINAL
UNITED NATIONS HQ.
UNION CITY
Lincoln Tunnel
PROPOSED L. I. R. R. TERMINAL
Midtown Tunnel
NEW JERSEY
PENNSYLVANIA STATION
HOBOKEN
GRAND CENTRAL STATION
Hudson Tubes
Holland Tunnel
EMPIRE STATE BLDG.
BROOKLYN
Hudson Tubes
JERSEY CITY
WALL STREET
Brooklyn-Battery Tunnel

The Great Subway Maze Is Still Growing

By Wesley S. Griswold

More subways will be welcome relief to "regulars," caught twice a day in a mighty squeeze.

New tunnels will soon carry more tracks and trains under Manhattan—but seats will still be scarce.

THE biggest underground railroad in the world isn't big enough.

If you could make a single, straight track of New York's 239 miles of subway lines, it would reach from New York to Alexandria, Va. Yet work is to begin this summer on a new line that will add 29 miles more, extending beneath Second Avenue from Manhattan's lower East Side, past the gleaming United Nations Headquarters and the fashionable East River residences uptown, to connect with existing lines in The Bronx.

WHERE YOU CAN GO ON A DIME. Someday New York City may have, in addition to the Second Avenue subway for which excavating is about to begin, a new underground line linking it with New Jersey, which funnels more than 185,000 commuters into Manhattan daily.

EDITOR'S NOTE: ***Visitors to New York find one of the city's most amazing sights beneath the streets, in the city's gigantic subway. No other transportation system hauls—and mauls—so many people so far so fast. Even those who ride it regularly get lost regularly in its 13,000 trains and 500 stations.***

But even this will be only the beginning of a new expansion program.

Every weekday, more than 13,170 subway trains travel under New York streets. It would take every last locomotive on the Chesapeake & Ohio, Baltimore & Ohio, Denver & Rio Grande Western, Southern Pacific, Chicago & North Western, Missouri Pacific, New York Central and Northern Pacific railroads to haul that many trains.

From Monday through Friday, the New York subways daily carry more than 4,700,-

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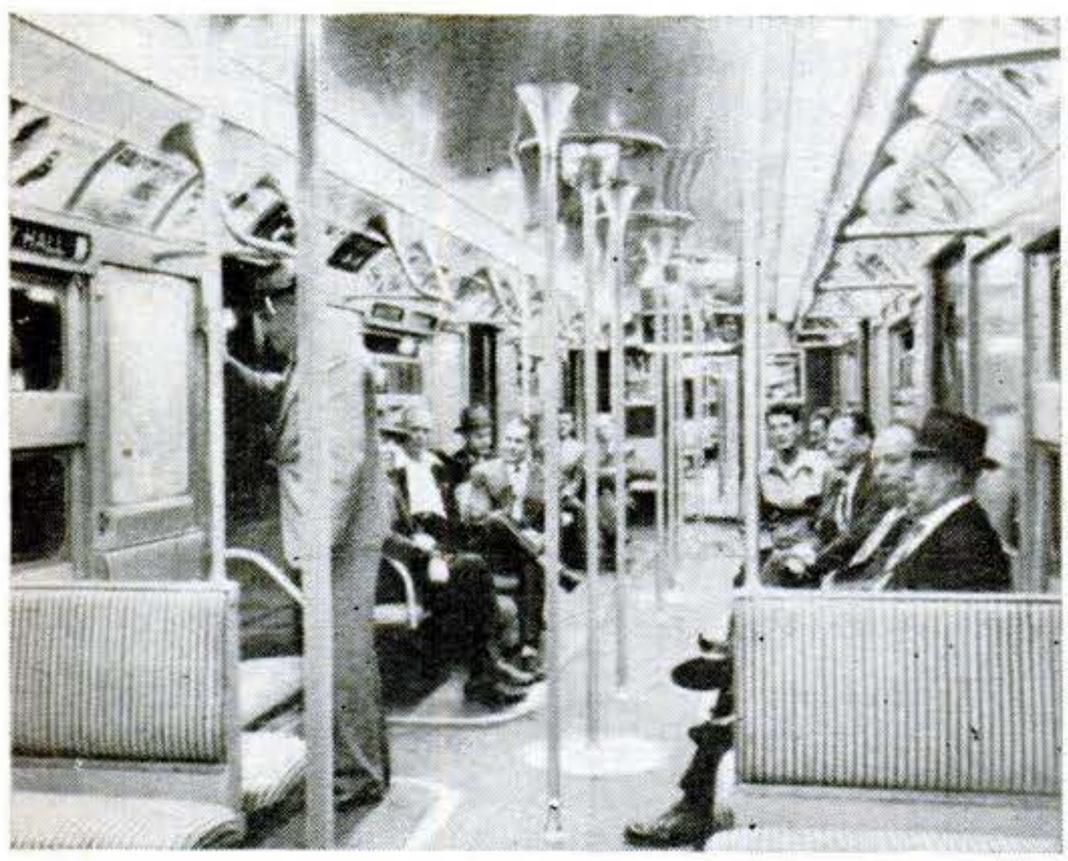
NEW SUBWAY TRAINS will probably look a lot like this one, built for New York in 1949. It is made of stainless steel and has both vertical and horizontal shock absorbers.

STATION CALLS, rarely heard on older trains, are made over a public-address system on the latest-type subway. Conductors also use the device to direct and caution riders.



MORE ROOM TO STAND is a feature of New York's newest subway equipment, in which the lighting is fluorescent, the air sterilized and the dust removed electrically.

000 passengers, as many people as live in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico and Utah combined.

Yet long-range planners are seriously considering proposals to lure a lot more people into traveling to and from Manhattan Island underground. One plan calls for building a beltlike subway connecting New Jersey railroads with certain key points in New York City. This subway would require two tunnels under the Hudson River and a new route under the city from the Radio City area to the lower tip of the island.

Fastest Subway in the World

Of the 17 subway systems in the world, New York's is the fastest, running a train every two to four minutes during peak traffic hours. (Rome's is the slowest, sending a train threading its way among the foundations of two-thousand-year-old buildings every two hours.) Except in case of an occasional breakdown, passengers on the main routes are never kept waiting more than 20 minutes for a train, even during the middle of the night.

The New York subways have a rolling stock of 6,800 cars, more passenger cars than the Kansas City Southern, Illinois Central, Great Northern, Santa Fe, Union Pacific, Atlantic Coast Line, Southern and Wabash railroads could muster altogether.

Subway trains are made up of from three to 10 cars, each one regularly inspected every 1,000 miles, and are not allowed to travel faster than 50 miles an hour. Over 3,500 motormen drive the trains, and 4,344 conductors control the car doors, taking care not to leave any arms or legs sticking out as each train departs from a station.

More than 260 dispatchers and as many more assistants control subway traffic, following the progress of trains between stations by means of consecutively flashing lights on control boards.

Cheapest Train Ride on Earth

Of New York's 500 subway stations—nearly as many passenger stations as the world's largest surface railroad, the Pennsylvania, has along its 25,000 miles of track—the busiest is at Times Square, center of the theater district. More than 48,000,000 people, as many as there are in the entire South, passed through its turnstiles last year.

Most of the subway stations are only about one story below the sidewalks, and strollers above can often feel the rumble of

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HEADED FOR NEW YORK STREETS. The biggest U.S. city, plagued by traffic snarls, may have to build still another subway and try to get these people to use it instead of their cars.

passing trains in the soles of their feet. One station, however, is 184 feet below the street, a distance equivalent to the height of a 14-story building.

Though the cost of riding on the New York subways rose from a nickel to a dime in June, 1948, they still provide the cheapest long-distance train ride on earth. For 10 cents a passenger can travel 23¼ miles, in 74 minutes, without having to change trains. The outermost points of the huge underground railroad are 27.27 miles apart.

Brother, Can You Spare 700,000 Dimes?

It is a long-standing, sour joke among New Yorkers, grateful as they are to be able to ride so far for so little, that their subways always run at a loss. For instance, in the six months ending December 31, 1951, though the subway system had collected nearly $75,000,000 in fares—considerably more than the U. S. Treasury collected in taxes in any year prior to the Civil War—it was already more than $7,000,000 in the red.

Passengers who dropped slugs or foreign coins into the subway turnstiles—one in every 26,500 fares—were a minor source of financial loss. The city's Board of Transportation used to dump this dubious revenue periodically into New York Harbor. Last December, however, it finally recouped some of its loss. It sold 37,803 coins from 29 foreign countries to a Broadway dealer for about $1,700.

A much more impressive source of income for the New York subway system is its slice of the sale price of all goods and services provided on hundreds of its station platforms. Here passengers can buy peanuts, candy bars, packaged crackers, chewing gum and soft drinks from vending machines; purchase flowers, bakery products, mixed nuts, boxes of candy, books, magazines, newspapers, and complete light lunches from shops and stands; have their shoes shined; store their packages in coin-operated lockers; and avail themselves of pay phones and pay toilets. From this commercial hurly-burly the city in 1951 extracted slightly less than $5,000,000.

Naturally, the discarded wrappings, abandoned newspapers and wads of gum left in the wake of subway riders pose a major housekeeping problem. Thousands of waste-

[*Continued on page 214*]

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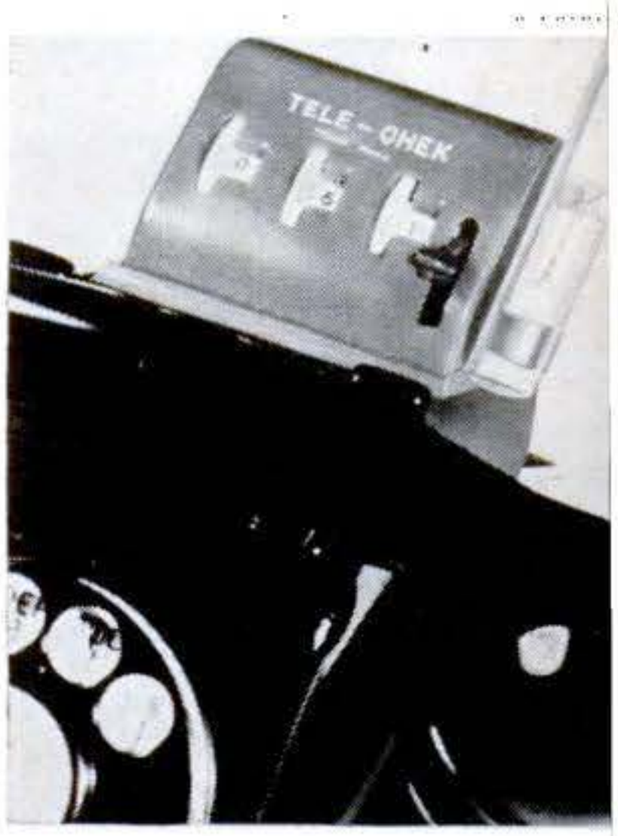
TV Checks Names on Checks

TELLERS at a Baltimore bank can compare signatures on checks and other documents without keeping customers waiting. An industrial TV system pipes images from a central record room to tellers' cages. Photo below shows RCA's miniature industrial camera (on stand) and monitor screen. Sloped cabinet on top of monitor is an intercom. Receiving setup is pictured at right.

Meter Counts Telephone Calls

THIS telephone meter will keep tabs on how many outgoing calls you make during the month. Just press the lever each time a call goes through and the tally shows at a glance. And the little sand glass warns you when a three-minute conversation is about up. Shelba Co., 37 West 23 St., NYC, makes it.

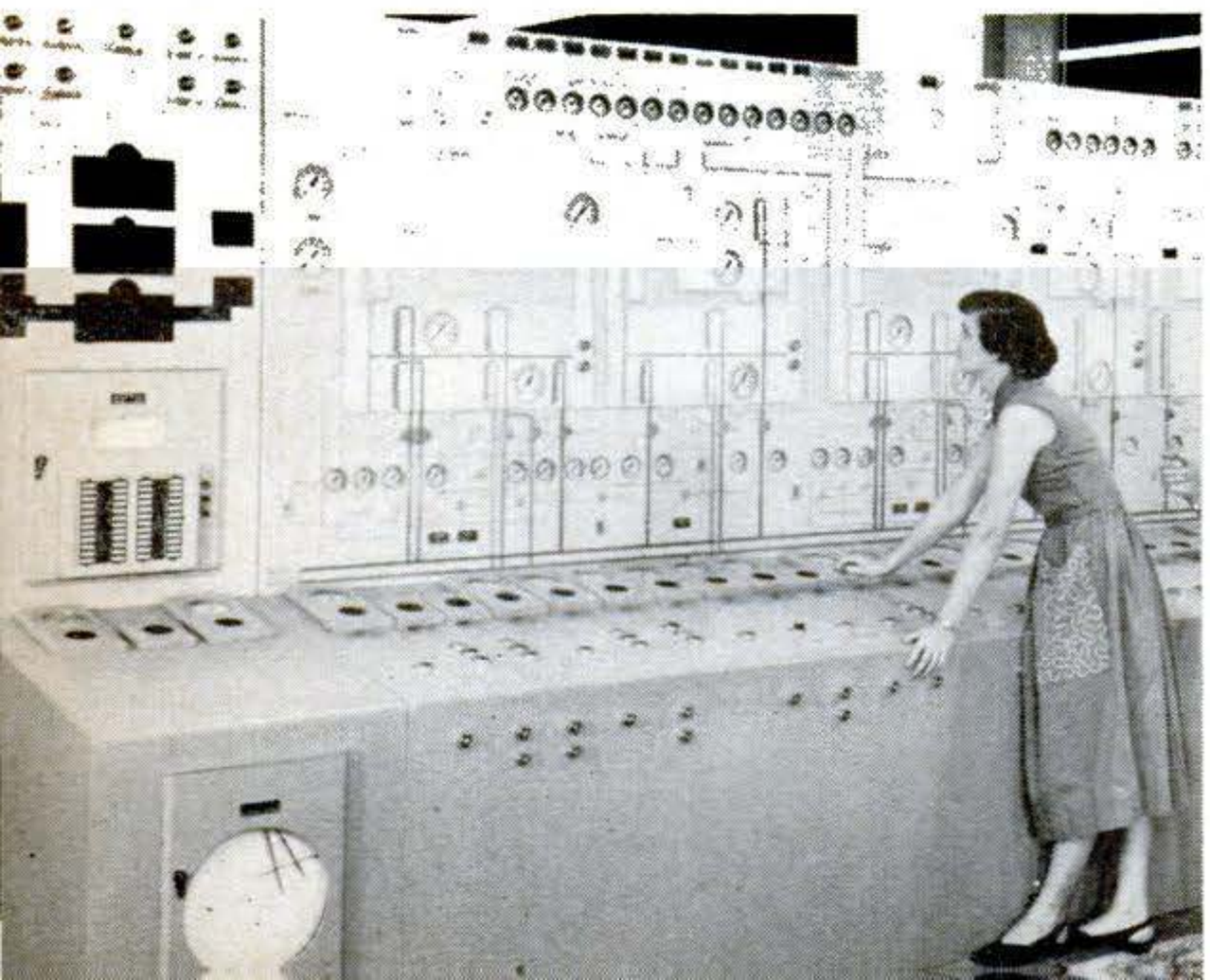


Panel Keeps White House Cool

THE heat of an election year won't affect the White House. An electronic control panel (below) regulates temperature and humidity. It monitors 106 thermostats that control the air-conditioning system—most elaborate ever installed in a residence. From it, conditions all over the President's mansion can be adjusted when necessary.

Sportsmen Stay Dry in Parka

THIS plastic suit will keep a boatman dry through drenching rain or heavy spray. A two-piece outfit—parka with attached hood, and trousers with built-in suspenders—it offers more freedom of movement than a sou'wester and stiff oilskins. It's a good bet for fishermen, too. The Mardo Sales Corp., 480 Lexington Ave., NYC 17, sells it.



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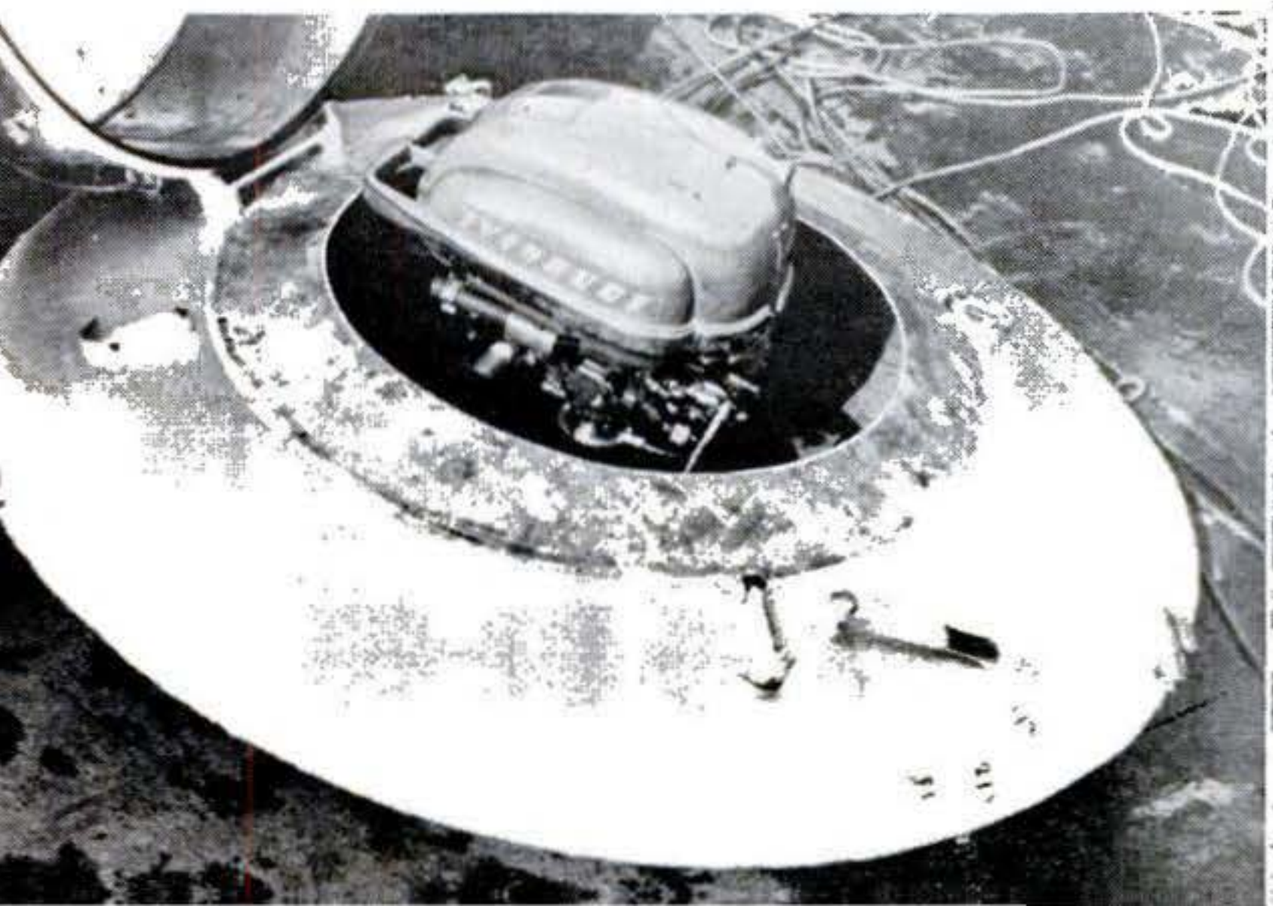
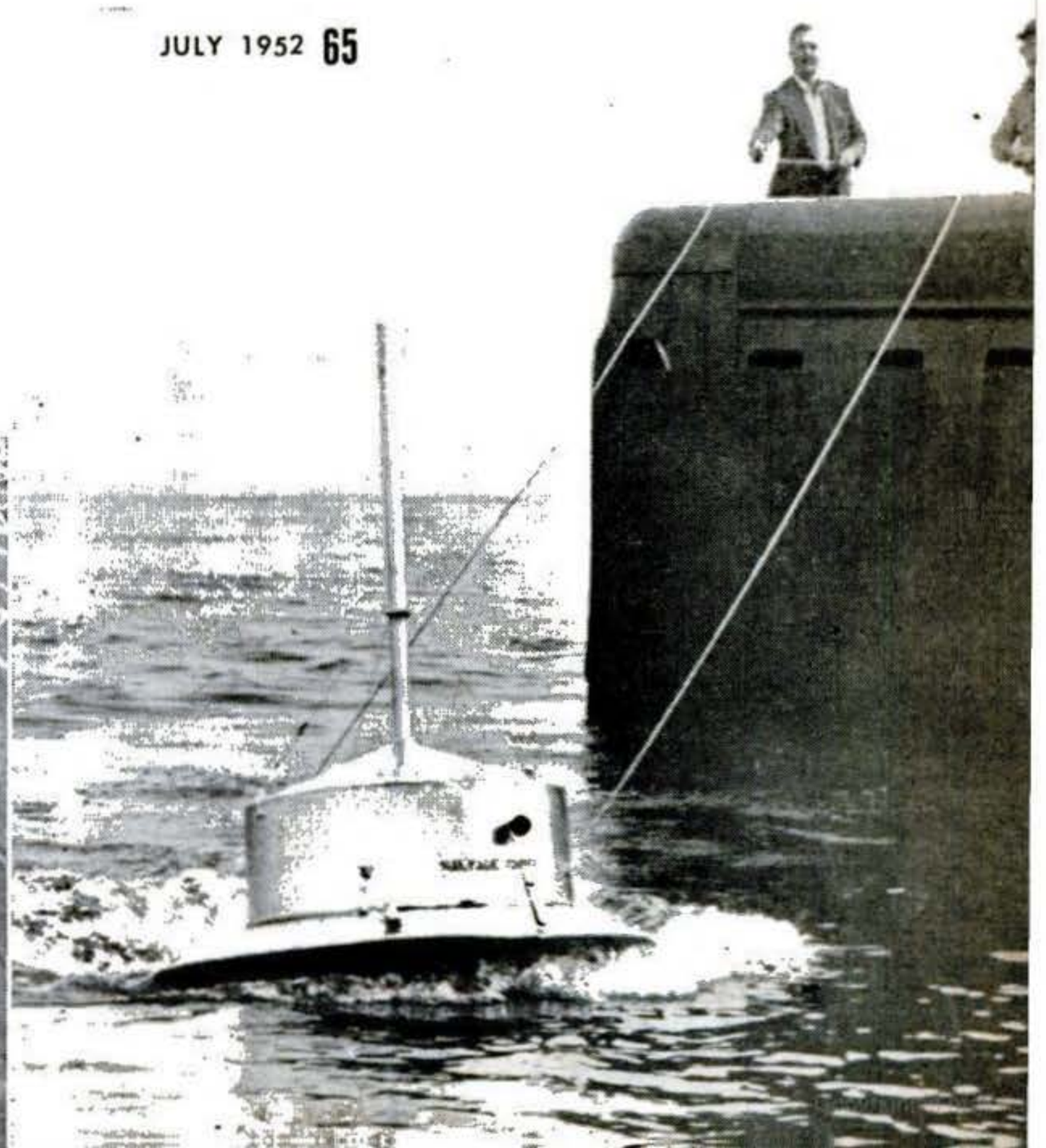
Tandem Rotors Lift Biggest Military Helicopter

ALTHOUGH it looks like an emaciated dirigible with a sag in the middle, the YH-21 Work-Horse can haul 14,000 pounds of cargo—more than any military helicopter now in use—or carry 12 litter patients plus medical attendant and crew of two. Designed for Air Force arctic rescue work, the 52½-foot craft will land on ice, snow, water, tundra, marsh or land. Encaged bags at the wheels can be inflated from the cockpit to form doughnut-shaped floats. Where landings are not feasible, a swinging-boom hydraulic hoist will lift litters from the ground. Made by Piasecki, it will also appear in two other versions—an assault helicopter and a 20-passenger troop carrier.

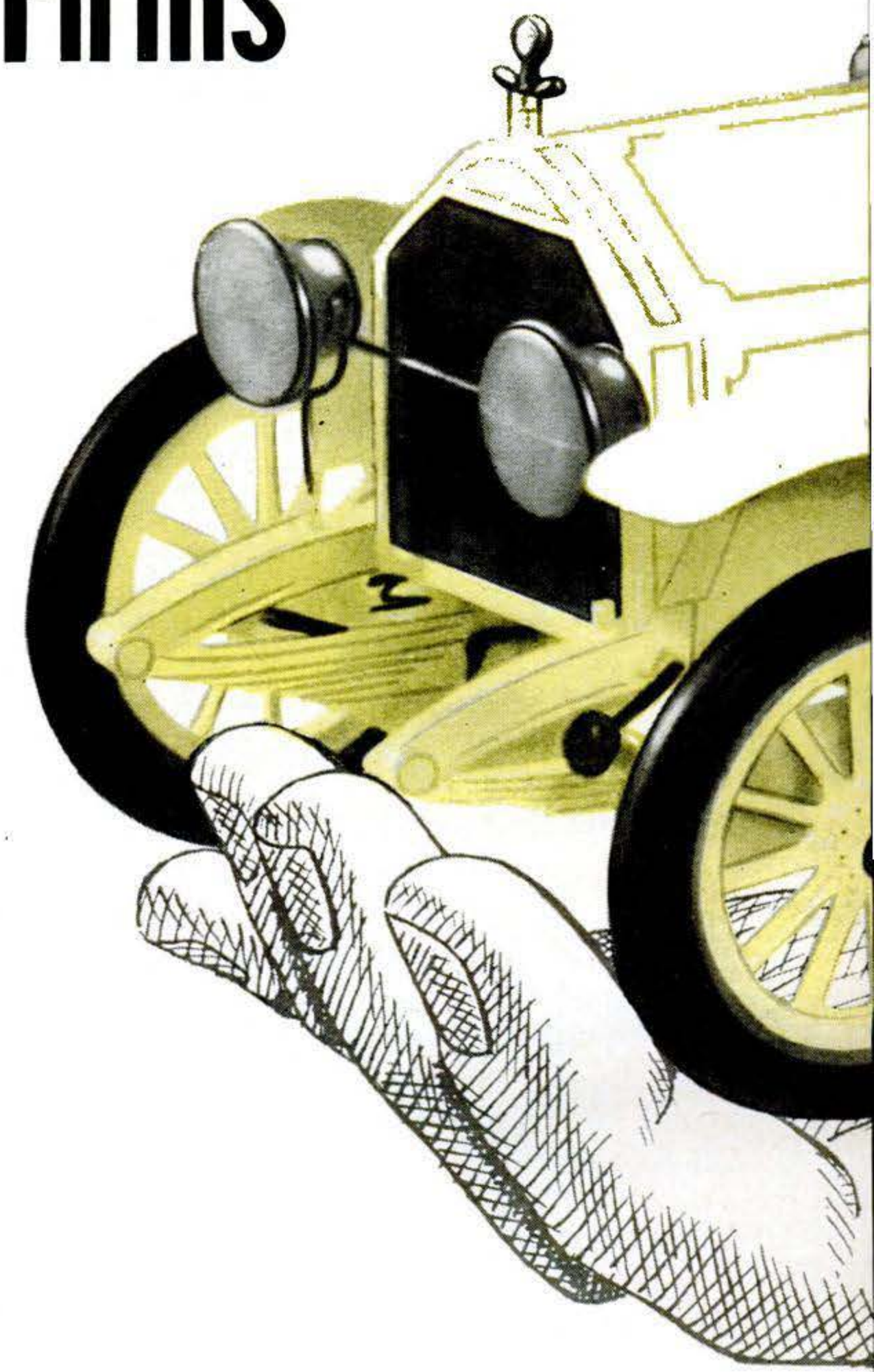
Floating Saucer to Carry Salvage Line to Stranded Ships

THIS seagoing saucer is designed to run a line from a salvage vessel to a stranded ship. An outboard motor, modified for shallow draft (below), propels it. A snorkel tube feeds in oxygen when the airtight lid is down (right). Two ropes steer the device. The inventor, Stanley Ehrlich of Portland, Ore., says he can make it turn around in its own track, return to the ship, or otherwise control it from hundreds of feet away.





Million-Dollar Firms Grow from Hobbies



Assemble-it-yourself kits have turned the model-building urge into a business bonanza.

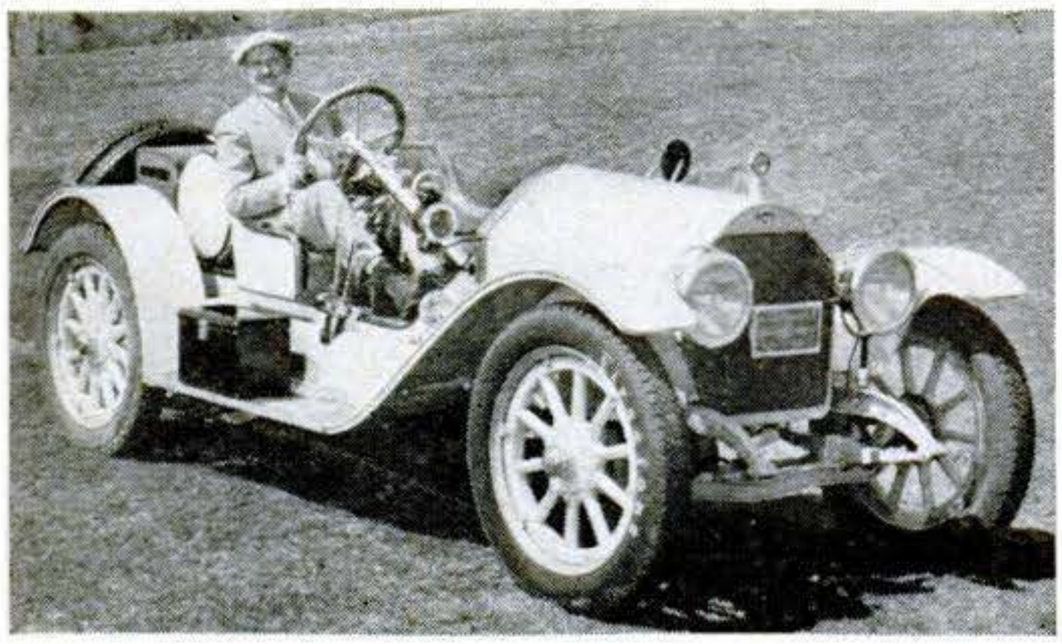
By Stephen R. Philips

PSM PHOTOS BY W. W. MORRIS

HOW would you like to do, in a big and highly profitable way, what you did just for fun as a kid? About 200 young men are in that enviable spot right now. And, what is more, they have created in the process a new industry.

These men are the manufacturers of model kits and supplies. In knee pants they whittled and glued because it was fun—in long pants they design and create miniatures for other hobbyists to assemble because it's still fun and jangles the cash registers as well.

A model kit, sold in a gaily colored carton, consists of prefabricated bits and pieces which are put together at home by cutting, pasting, soldering, painting. Hundreds of separate objects, ranging from prairie schooners of pioneer days to the latest jet-powered fighters zooming over Korea are on the market, selling at anywhere from a dime to $50.



ASSEMBLY-KIT MANUFACTURER KOVELESKI at the wheel of his prize-winning Stutz Bearcat. It served as model for build-it-yourself miniature of same car, shown at top of page.

Grandson is a customer and so is gramps himself, and in between are stage and screen stars, public officials, corporation executives and just folks who like to make things when the day's work is done. Henry Fonda is a devotee and Gypsy Rose Lee is, too.

Another famous fan is actor Yul Brynner, who plays the role of the King of Siam in the Broadway production, *The King and I.* Brynner is an HO train addict. He puts trains together from model kits in his dressing room while waiting cues. With jeweler's precision, he has just assembled a locomo-

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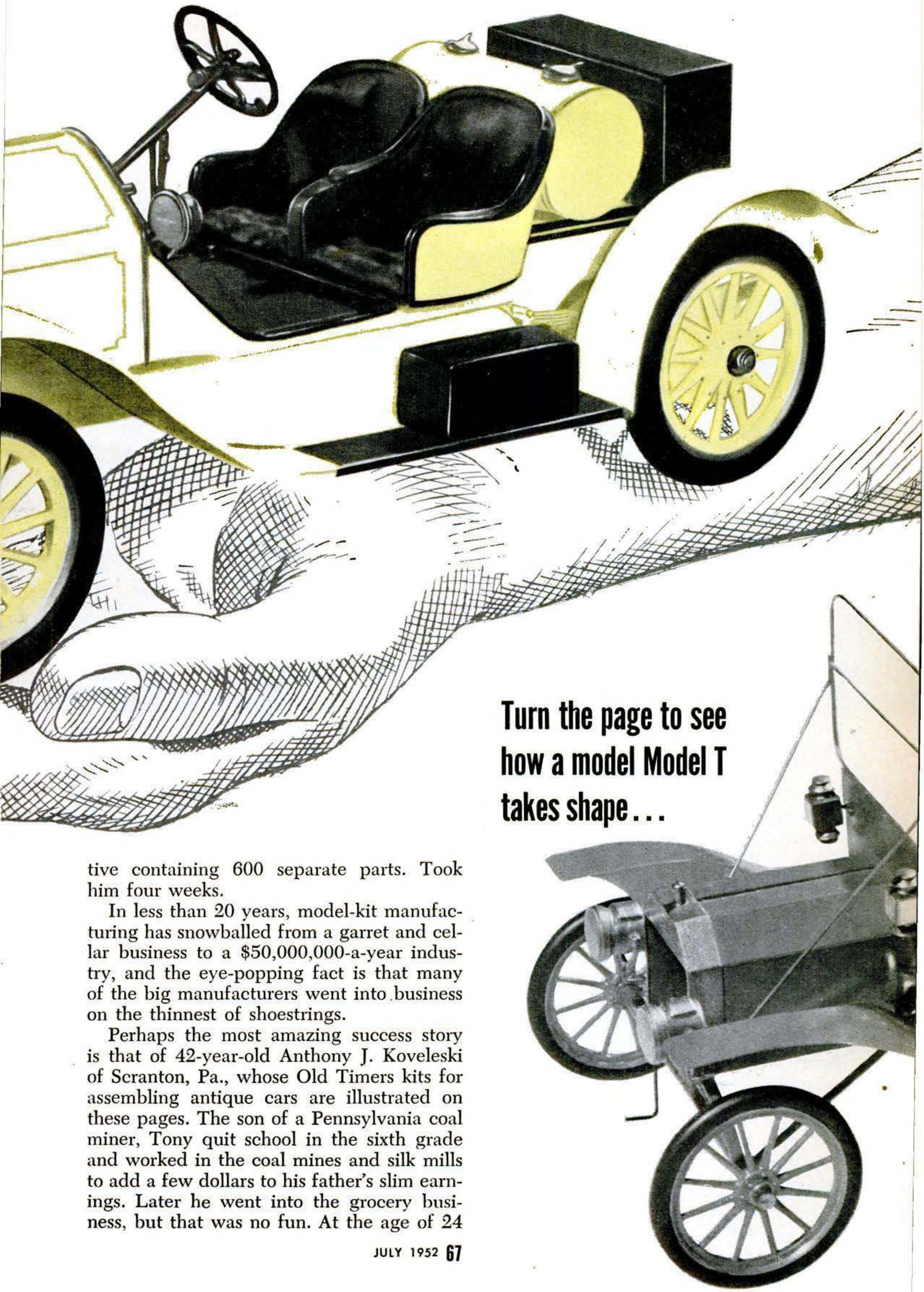

Turn the page to see how a model Model T takes shape...

tive containing 600 separate parts. Took him four weeks.

In less than 20 years, model-kit manufacturing has snowballed from a garret and cellar business to a $50,000,000-a-year industry, and the eye-popping fact is that many of the big manufacturers went into business on the thinnest of shoestrings.

Perhaps the most amazing success story is that of 42-year-old Anthony J. Koveleski of Scranton, Pa., whose Old Timers kits for assembling antique cars are illustrated on these pages. The son of a Pennsylvania coal miner, Tony quit school in the sixth grade and worked in the coal mines and silk mills to add a few dollars to his father's slim earnings. Later he went into the grocery business, but that was no fun. At the age of 24

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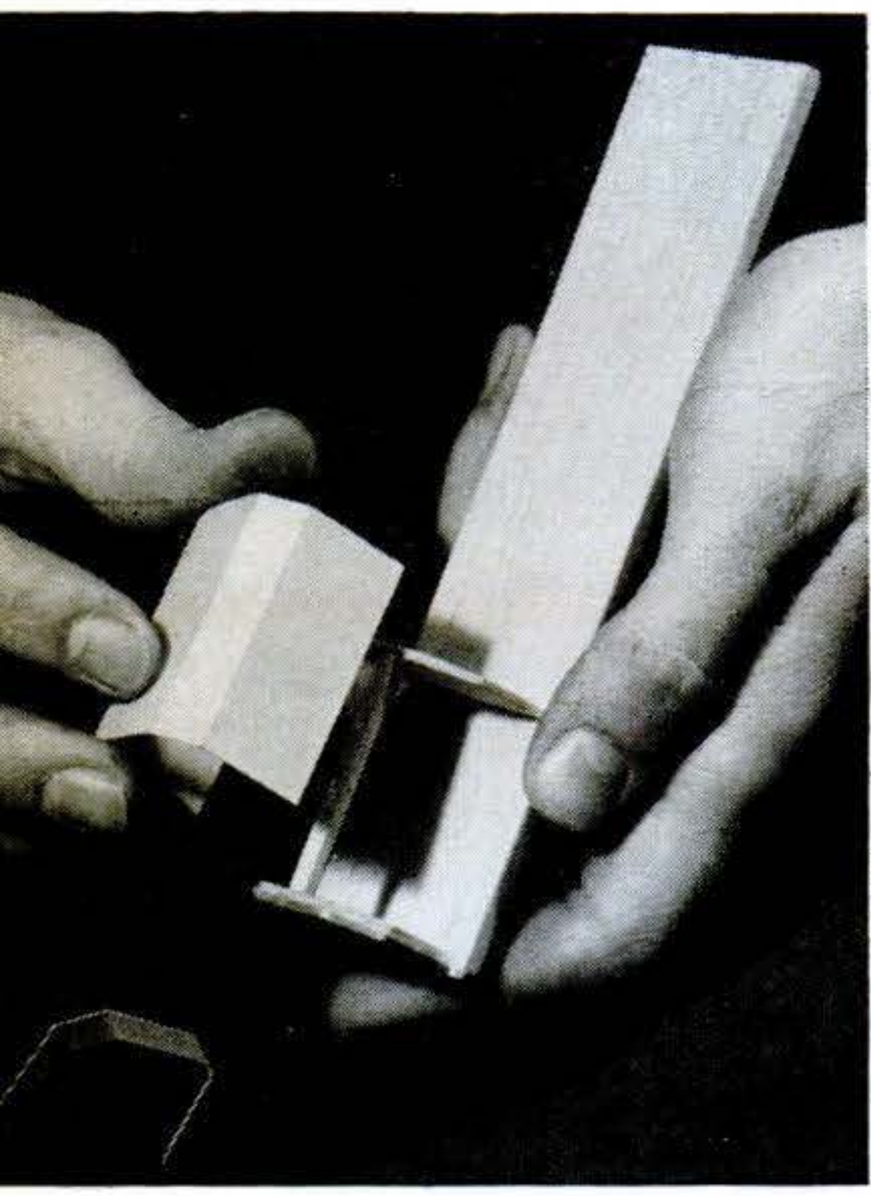
he decided that it was high time he caught up on his boyhood.

With a $30 investment he started a hobby shop in Scranton. That was fun, made people happy—and coined money. Then, four years ago, after serving as an instructor of flying instructors in the Army Air Forces, he organized Hudson Miniatures to put out his antique-car kits. So far he has rung up sales of $2,000,000 with business getting better and better.

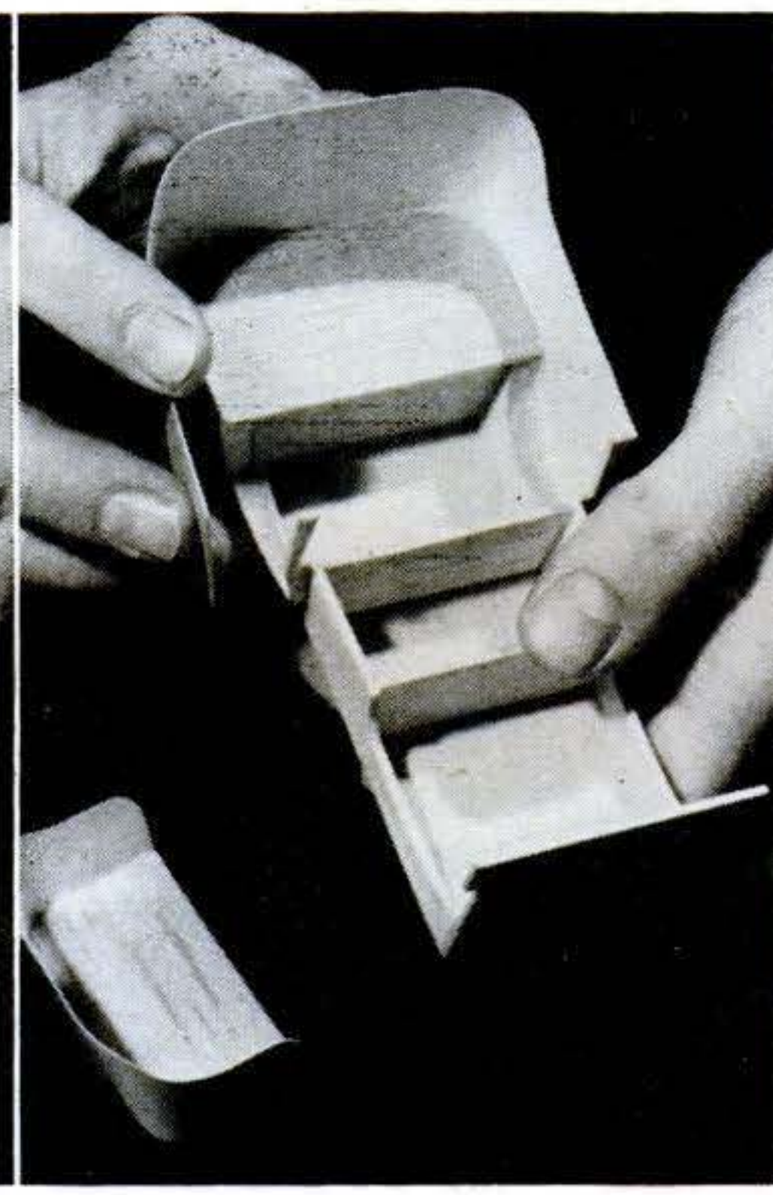
Koveleski's interest in automobiles dates back to one day when he was eight years old. A big-shot gambler in his hometown of Kingston, Pa., took him for a spin in a flashy Stutz Bearcat.

"That was the most thrilling experience of my life," says Tony. "I sat on a curb after that ride and made up my mind that some day I was going to own a Bearcat."

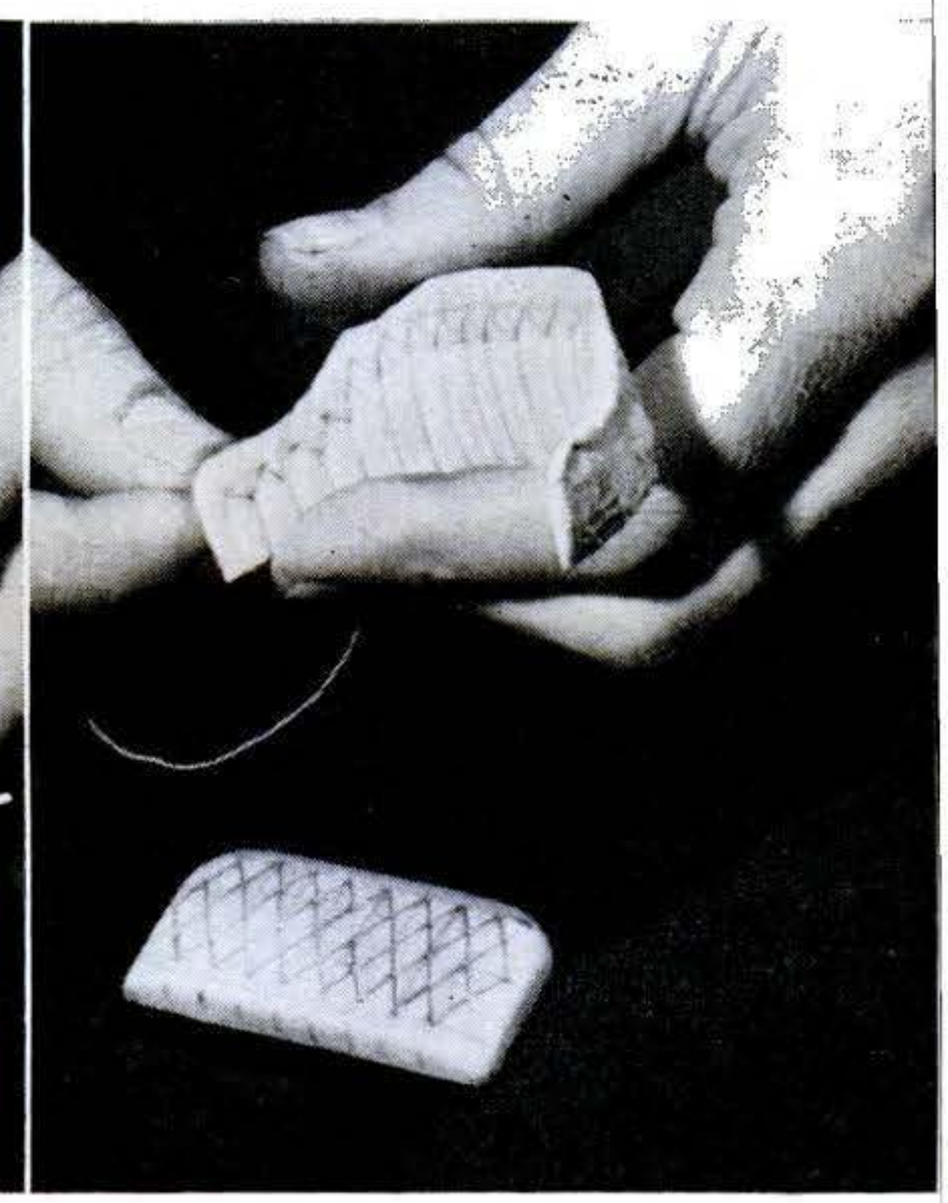
Thirty years later he did, but by that time it was a 1914 antique—one of the rarest in the country—and holder of seven First Prizes in old-car competitions. Today, in



1 OLD TIMERS KIT for 1909 Model T has more than 80 prefabricated parts. Assembly begins with balsa-wood floor. Here hood cover, formed of cardboard, is being fitted.



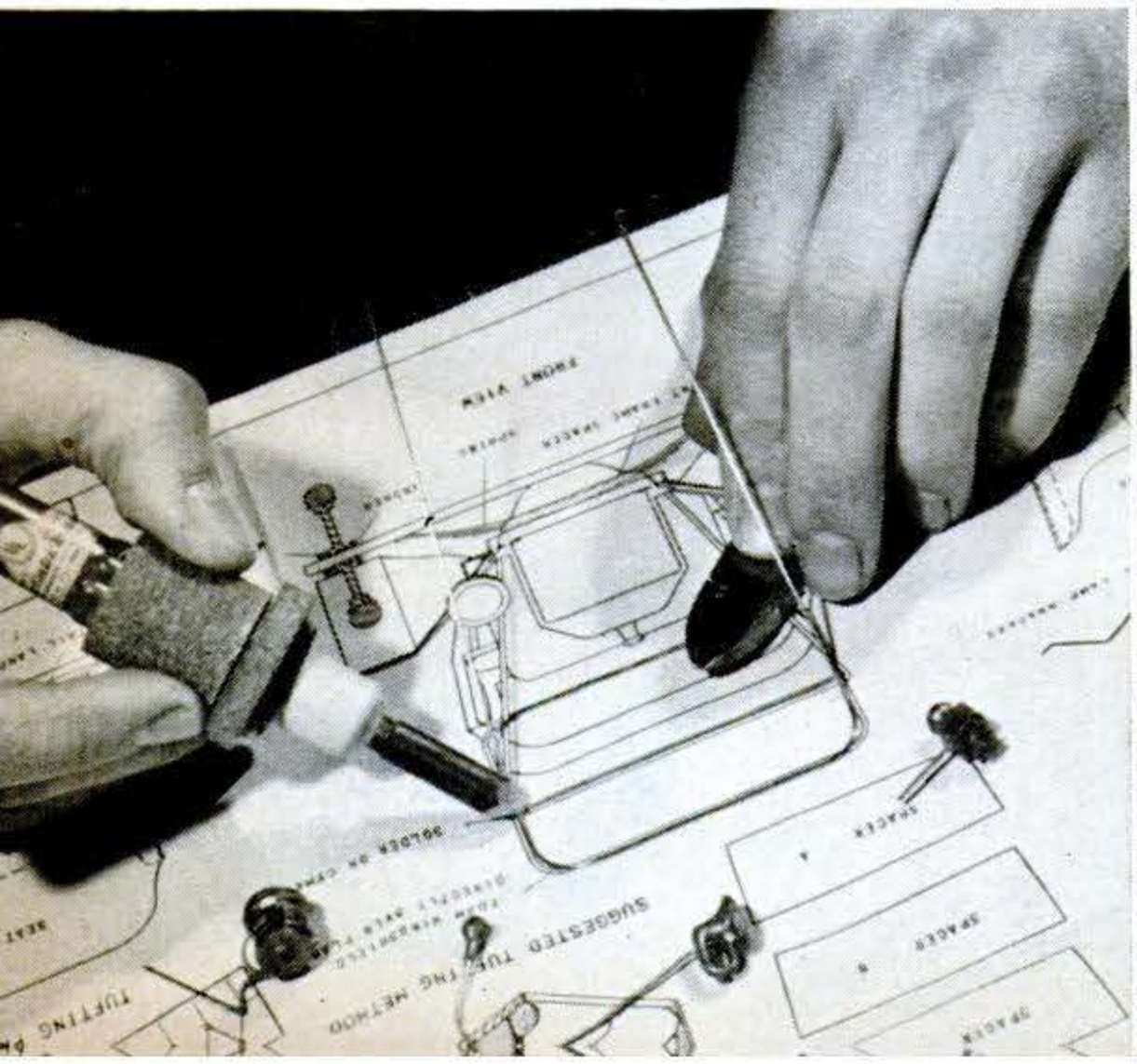
2 REAR-SEAT BACK, of die-cut balsa, is formed around body and glued in place. Next, front seat, seen in foreground, is put in place. Detailed plans identify all parts.

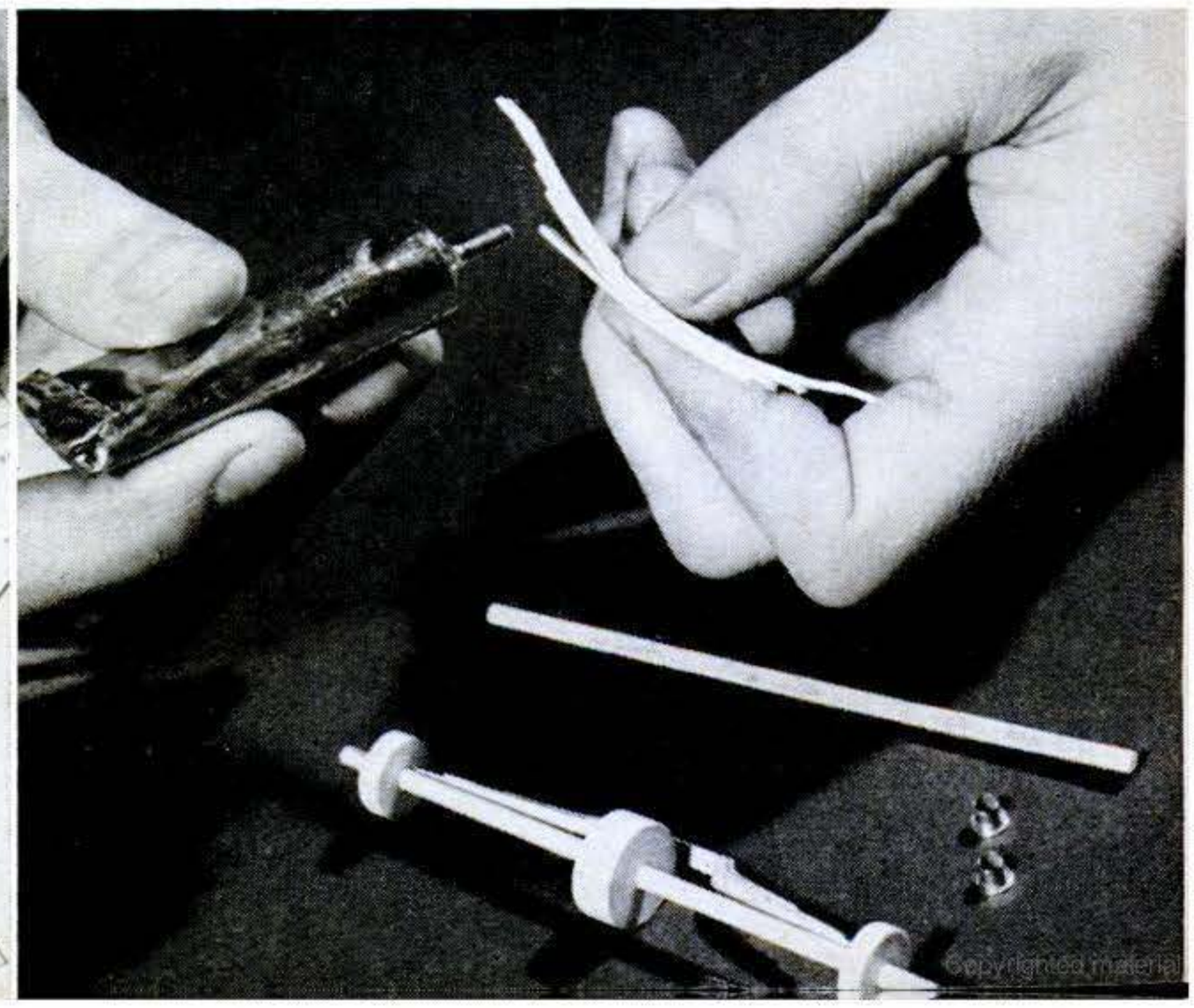


3 UPHOLSTERY can be simulated by gluing in pre-cut balsa strips. For more elaborate job, muslin is stretched over layer of cotton and hand-tufted with needle and thread.

5 WIRE WINDSHIELD FRAME is bent to shape directly over diagram, and wire supports soldered in place. Wire lamp brackets and horn hose (foreground) have been completed.

6 SPRINGS are made of fiberboard strips. The leaves are cut to size and assembled and glued together. At bottom is shown rear axle with differential and brake drums in place.





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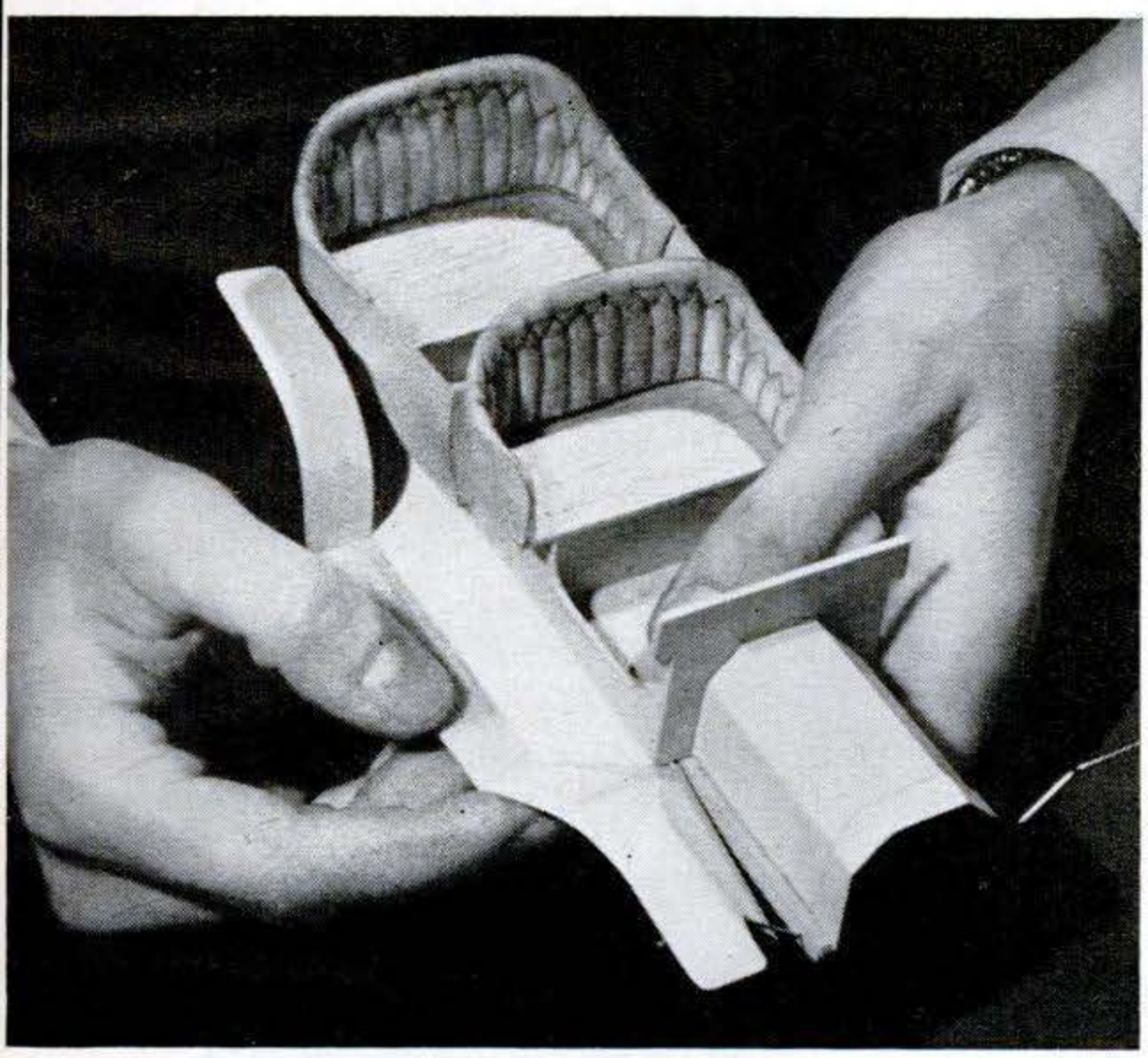
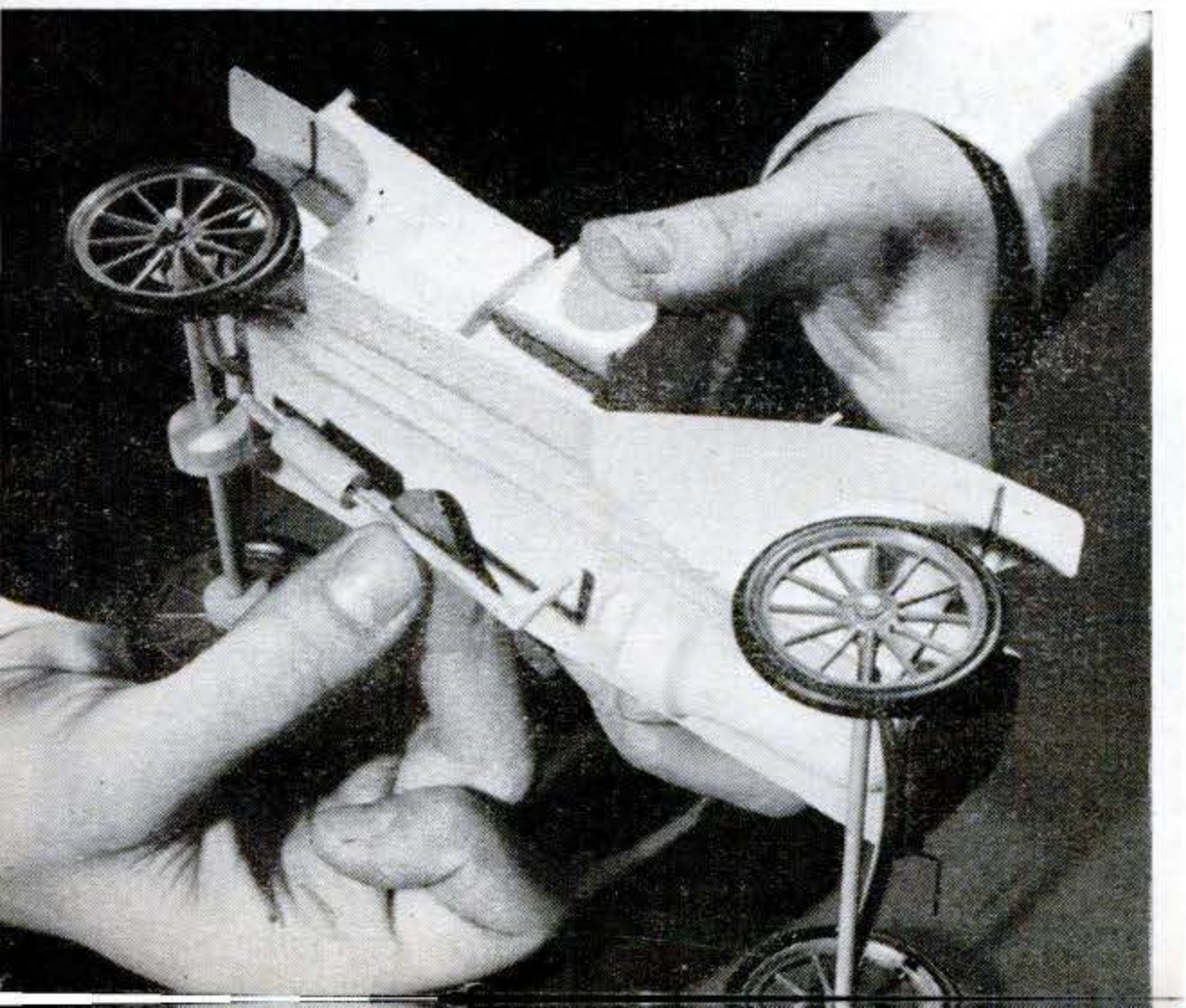
three garages scattered around Scranton, he has more than a dozen antique cars. A machinist, he has rebuilt them himself, to the last authentic accessory. They serve as full-size models for his miniature assembly-kit cars, which reproduce in exact scale every measurement and detail.

Another young man, William L. Effinger Jr., president of Berkeley Models, Inc., of West Hempstead, L. I., expects to sell $1,500,000 worth of kits and supplies this year. He started in 1933 with a total cash investment of—hold your breath—$2.75.



4 CAR TAKES SHAPE. Body with seats installed has been joined to frame and engine-hood assembly. In this photo fenders are being fastened to running board. Bent-wire fender supports can be seen in foreground, already attached to radiator base.

7 WITH WHEELS in place, muffler unit is mounted. A few more parts and fittings, and car is ready for painting. Average assembly time for finished job is eight hours.



There was an old carriage house in the rear of Bill's Brooklyn, N. Y., home, where the neighborhood kids would meet to build model planes. They needed supplies and Bill, while still in high school, decided he was the boy to provide them. He invested his $2.75 in balsa wood and, using a home-workshop saw, cut it into usable pieces. Then he bought wire, paper, glue. The kids were delighted and Bill's pockets soon jingled with cash.

Several years and about $1,000 later, Bill put out his first construction kit. It sold so well that his father joined him, handling business details while Bill was studying for an engineering degree.

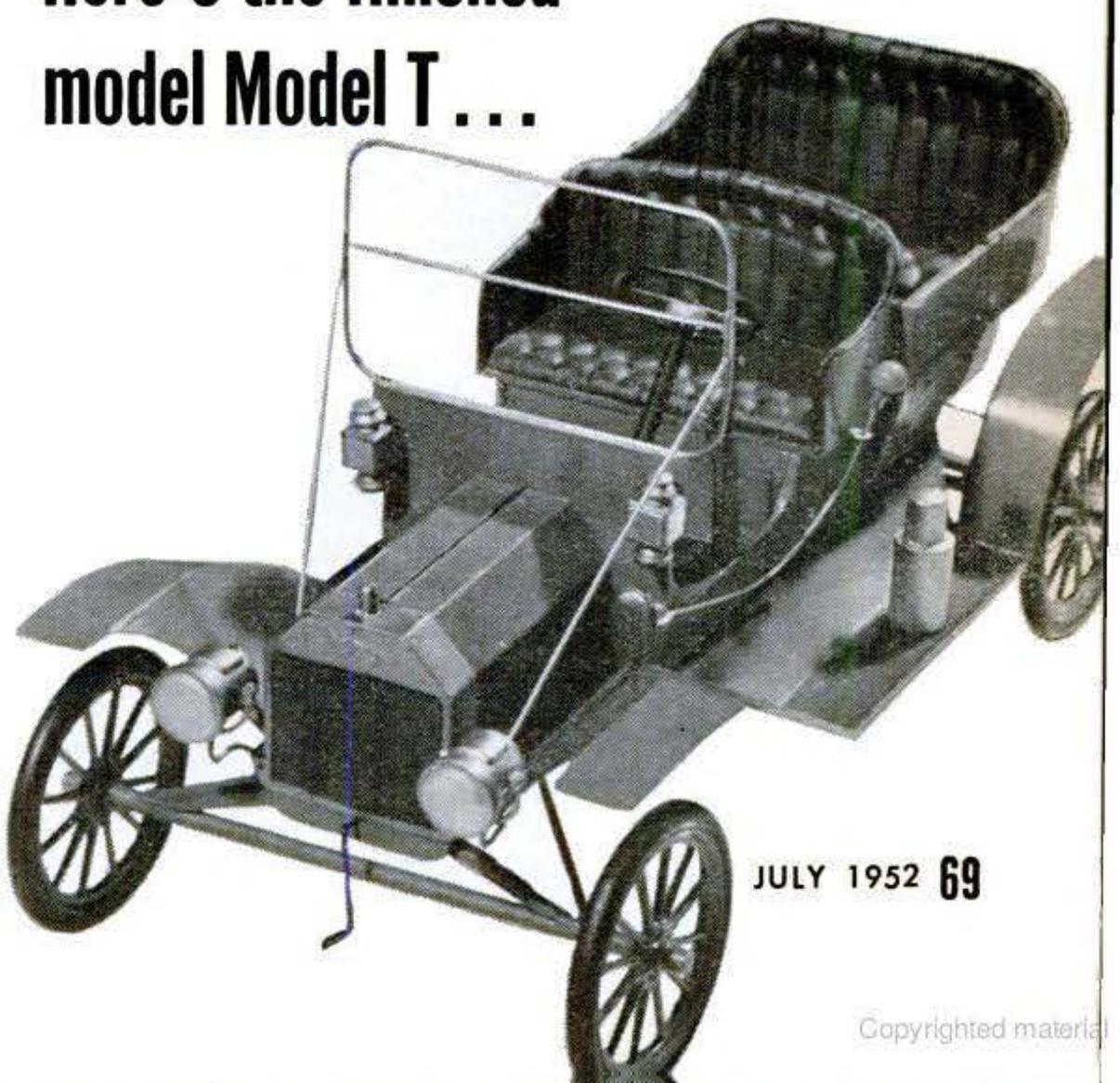
In 1938, Bill's plant outgrew the carriage house and he took over a two-story structure. Then followed a succession of moves to larger quarters as sales soared, until now he runs one of the largest model-kit plants in the U. S.

Model-Kit Bug Bites Early

This fascinating industry, which has given so many hobbyists a chance to cash in, was actually born following the first world war. But it was an anemic infant and didn't begin to perk up until Charles A. Lindbergh hopped off one dawn in 1927 and made the first solo transatlantic flight. He planted aviation in everyone's mind. Then came the stock-market debacle of 1929 which, paradoxically, provided another shot of vitamins for the young industry. Doctors urged overwrought businessmen to turn to "doing things with your hands" as a relief from tension.

World War II brought interest in matters

Here's the finished model Model T . . .



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aeronautical to fever pitch. Returning GIs, for whom new horizons had opened, put their new skills to work on amazing miniatures of boats, cars, railroads and flying equipment. The industry grew to manhood, husky, muscular manhood, and it's now reaching for more worlds to conquer.

The inventiveness of the model-kit makers is limited only by their imaginations. A virtual history of America is represented by the bewildering variety of miniatures which flows steadily from the designing boards and workbenches.

Fire Trucks to Sailing Ships

They range from pre-World War I aircraft to jets, antique autos to hot rods, tall-masted sailing ships to streamlined speed boats, covered wagons to tanks, Revolutionary War fire wagons to the newest shining apparatus, and practically everything to enchant a model railroader from the earliest days of steam to tomorrow.

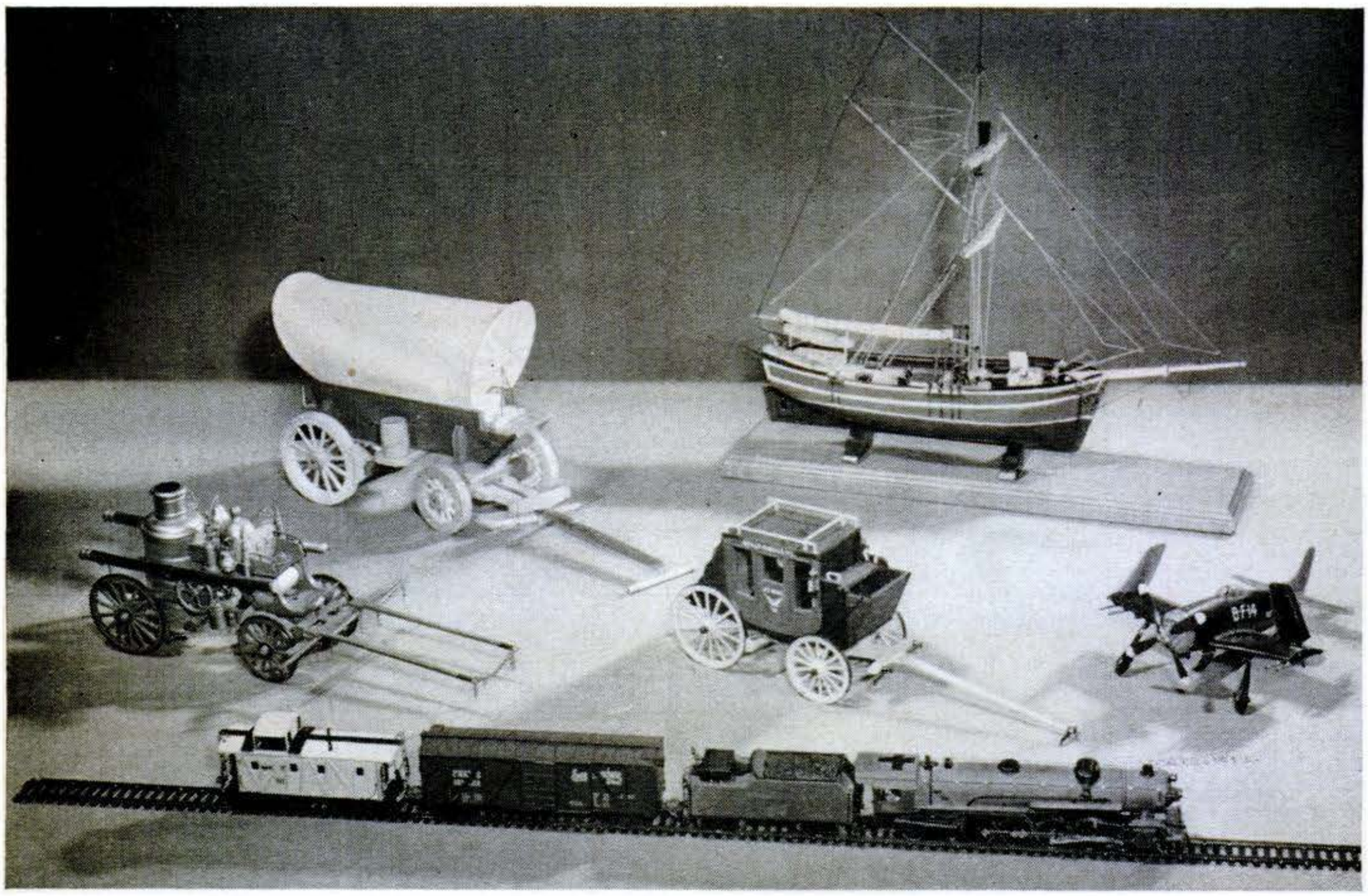
How about visiting one of these model-kit factories to see how things work from the inside? Bill Effinger's plant in Long Island is a dandy example. Let's take just one of the many kits which Bill's Berkeley Models puts out and trace it through from the germ of the idea to the time it lands on the dealer's shelf. His SNJ is a typical kit. Here's how it came about:

In planning a new line, Bill draws up a list of some 50 or 60 possible items, all well known planes and boats. From this list, he ultimately selects 10 or 15 which contain those features he believes will capture the imaginations of his customers. The SNJ (that's the Navy designation; the AAF called it the AT-6) was picked because it had taught more combat fliers than any other plane and Bill believed that the hundreds of thousands of pilots who had flown it would remember it fondly. Moreover, it had not yet been offered by anyone else on the market.

Design Follows Original

Having chosen the plane, Bill's next step was to get every possible scrap of available data so that the final model would be as exact a replica in miniature as possible. From North American Aviation he obtained three-view drawings, pictures taken at all angles and other specifications. From the

[Continued on page 210]



ASSEMBLY KITS are made to suit anyone's hobby, skill and pocketbook. Above are shown only a few of scores carried by Polk's Hobbies, New York. They range from the Ideal Model Wells Fargo stagecoach that sells for $1.50 and can be put together in a few hours, to the Bowser locomotive and tender kit that costs $37.50, takes months to assemble.

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Plane Dispatcher Pilots Scooter

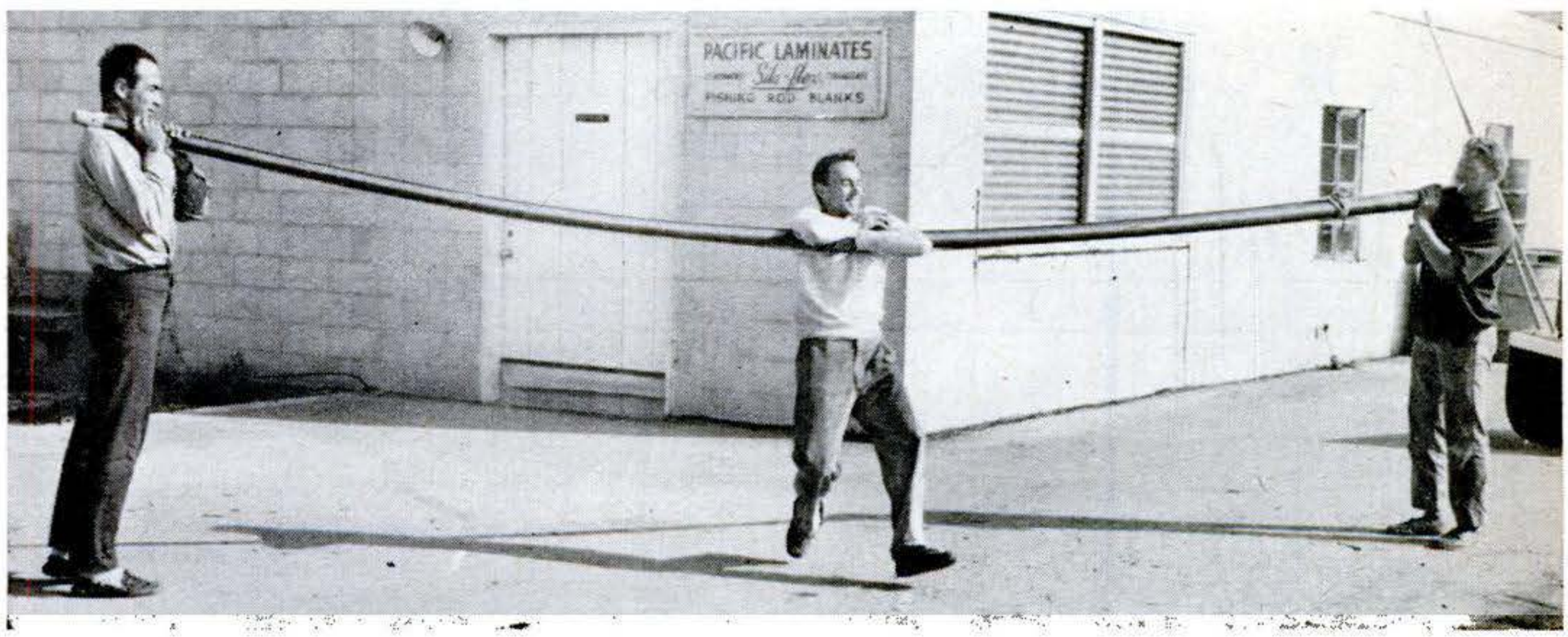
THE rider of the tiny, fractional-horsepower Corgi above is a busy man at London Airport. He scoots from plane to plane, examining the condition of the runways as he rides. He gets the pilot's okay on every British European Airways plane before take-off, checks catering arrangements and radios in his reports via walkie-talkie.

Mobile Drill Digs Wells Fast

EARL SUTTON of Evansville, Ind., had a nice homesite, but no water. Two hours and 10 minutes after the drill rig above rolled onto the property, he drank from his own 60-foot well. The rig, designed for rotary, auger and percussion drilling, is mounted on a truck having power take-off. Mobile Drilling, Inc., Indianapolis, makes it.

This Boat Mast Is Made of Glass, but It Won't Break

A 160-POUND man can swing from the middle of this 19-foot boat mast and it may bend a bit—but it won't crack or break. It is made by wrapping glass-fiber cloth around and around a form revolving on a mandrel. When slipped from the form, the spiral wrappings—nine layers thick at the base decreasing to five turns at the tapered tip—produce the hollow mast. Weight? Only nine pounds.



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What It's Like to Fly a Car

You can land this airphibious vehicle at an airport and then simply unhitch the wings and drive the body off into town.

By Wilbur Shaw and Devon Francis

PSM PHOTOS BY HUBERT LUCKETT

A FEW years ago a calm, personable gentleman named Robert Edison Fulton Jr. got mad at an airplane. He could fly the thing from airport to airport, but he couldn't drive it on a highway. After he landed he had to scrounge around for a car or a taxi. It was exasperating. So Fulton decided to do something about it. He built an automobile with wings.

Now, after a quarter of a million miles of airphibious testing, he's getting ready to start production for sale this fall.

We've just flown the vehicle that Fulton calls his Airphibian. We've driven it, too.

You can park it in your garage. If you want to make a trip with it aground, step

Just leave the wings at the airport and drive the Airphibian home. Wilbur Shaw shows how.

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As much at home in the air as on the highway, flying automobile cruises nicely at 110 m.p.h.

on the starter, back out and take to the highway. It will sail along at speeds up to 60 miles an hour. If you want to fly it somewhere, drive it to an airport, attach the wings and take off.

Fulton thinks nothing of flying his machine several hundred miles between breakfast and lunch, taking off the wings and driving it a hundred miles or more, and then reattaching the wings for a flight of another several hundred miles before dinner time.

One person can put on the wings or take them off in less than five minutes. That, of course, is the secret of the thing's utility —the ease of the quick change.

Robert E. Fulton Jr.

We drove—beg pardon, flew—the automobile off Westchester County Airport, a few miles north of New York City. We had to take turns with Frazer Dougherty, test pilot for Fulton's company, Continental, Inc., of Danbury, Conn., because the Airphibian is only a two-seater.

"Climb in," invited Dougherty.

One long safety belt snugs in both pilot and passenger. There is only one control wheel and one set of rudder pedals—no dual controls.

The driving compartment—or cockpit, as you wish—looks like that of an airplane. There is the usual array of airplane dials and controls, only now the same ones are used for driving as well as flying the Airphibian.

"You want to know," remarked Dougherty, who must be psychic, "whether the wings are locked on securely?"

"It would help," we said.

"Okay." He flipped a switch. A check light glowed on the instrument panel. "If everything isn't all right, the light won't work. It's a safety device, just in case you forget something."

"And," we remarked, "if you don't happen to notice that the bulb's out, you take off and shed your wings in mid-air."

He grinned. "No, even if you tried to take

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TO UNMATE road and flight units, you first release two clamps in back of seat. Dubbed "sky hooks," clamps are two of seven locking pins that secure car to wings and fuselage.

THREE PINS extending from car body into sockets in fuselage are unscrewed next by cranks. As fuselage is released, foot brake, road transmission, engine fan automatically engage.

off, you still couldn't unless everything were battened down. You see, the engine starter wouldn't work, either."

We fired up. To taxi, you just rotate the control wheel as in a car. That turns the front wheels. In most small airplanes you have to turn by pushing on one of the rudder pedals to swivel the tail wheel.

"Just hold her straight," intoned Dougherty over the clamor of the engine as we gained speed on the runway. "Like guiding a car. Ease back on the wheel at about 65 miles an hour."

15 Minutes by Car—Two by Plane

We pulled back. The Airphibian came unstuck. We climbed. It was just like an airplane except that it was a car with wings.

The rate of climb was somewhat slow—about 585 feet a minute. That already has been remedied in a newer model, with more horsepower, that will climb 720 feet a minute.

The cabin was noisy because as yet it contained no soundproofing. We leveled off at 1,000 feet and set the throttle by the tachometer at cruising revolutions, around 2,400 r.p.m.

The Airphibian was stable in the air. It felt good. Flying slightly cross-wind, the airspeed dial indicating 110 miles an hour, we made it from the airport to nearby White Plains in two minutes. The same trip takes 15 to 20 minutes by car. Miles to the south, Long Island Sound sparkled in the sunlight. Miles to the west, the Hudson River flowed toward New York Harbor.

The air speed was just over 50 miles an hour as we flared out for a landing at the airport. The Airphibian settled a bit faster than we were accustomed to in this size of aircraft. But the landing was a sheer joy. We kept the nose a trifle high. The rear wheels touched and the front ones came down of their own accord. There was no shock, no tendency to bounce.

"Now!" said Dougherty as we parked and cut the switch. "Here's all you do."

In four minutes and 48 seconds, the wings, fuselage and propeller were off, and the Airphibian was an automobile. Dougherty locked the throttle in the closed position.

"The right rudder pedal is the brake," he explained. "The pedal to the right of that is the accelerator. The gearshift is that little lever on the floor just in front of the seat. It's sort of like a Hydra-Matic—there's no clutch—just push it forward to drive and back for reverse."

We decided that the complicated panel would prove confusing at first to the workaday motorist. As an automobile, the Airphibian is complete with turn signals, sun visors, rear-vision mirror, heater and license plates. The aeronautical radio works on standard broadcasts, too.

Flying on the Ground

"Now you release the hand brake," said Dougherty. That, instead of the foot brake, is used to shorten the landing run.

We stepped on the accelerator.

"Easy!" cautioned Dougherty. "You've got power to burn."

He was right. You could almost spin the rear wheels from a standing start. Before we knew it, the speedometer was reading 50 in a 30-mile zone. A traffic cop stared. We slowed down.

The tachometer indicated an astonishingly low r.p.m.—about 1,700—at 50 m.p.h.

For highway travel the Airphibian's ride

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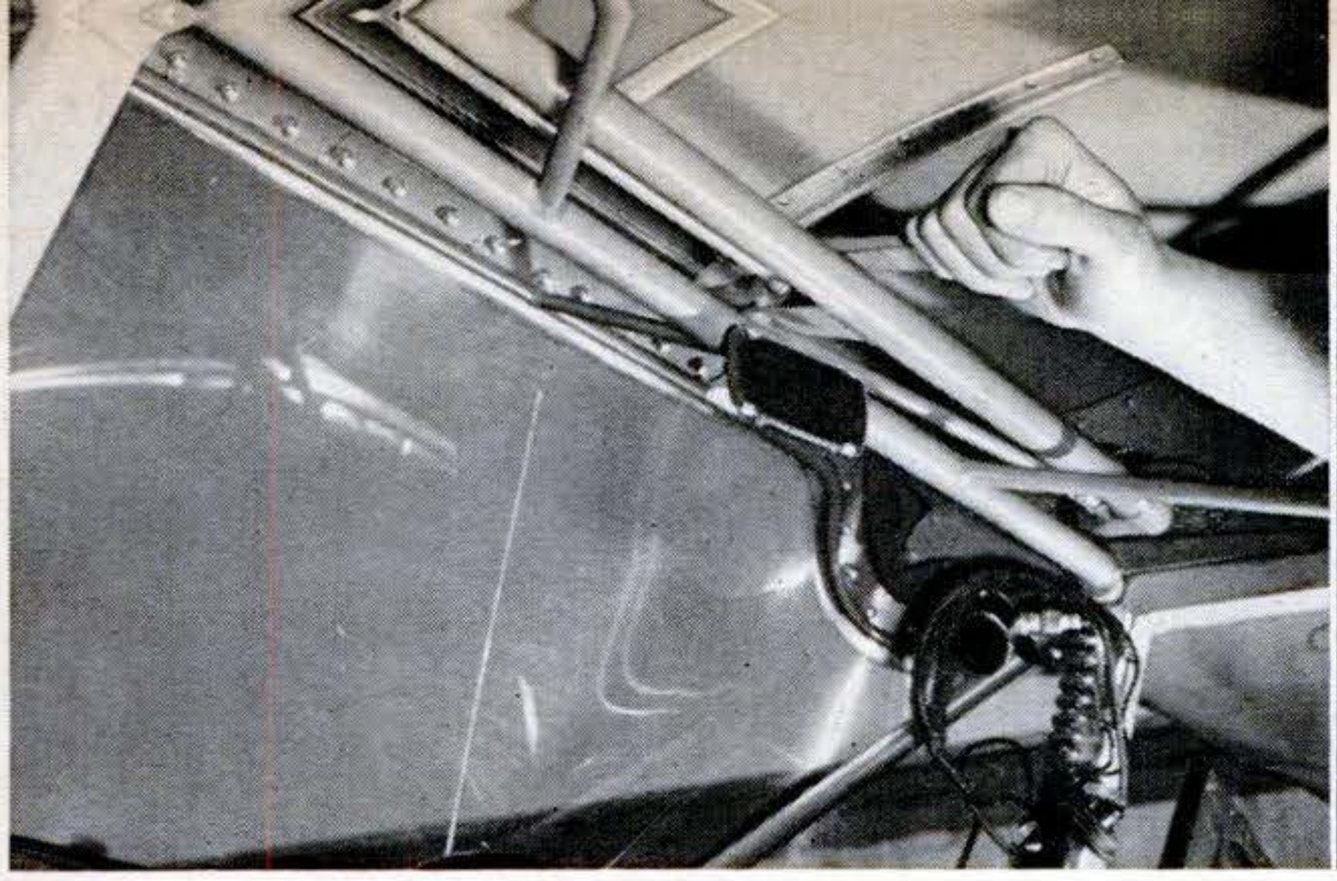

THIS LEVER unclamps front of car body from leading edge of wing. Outrigger wheels—which will disappear into wing in later models—also must be lowered along with tail wheel.

PROPELLER IS REMOVED in last step, as Shaw is doing here, with built-in wrench that unscrews it from front drive shaft of engine. He will transfer prop to stud on side of fuselage.

DETACHED FUSELAGE is left standing on its outriggers and tail wheel, and car is ready to roll on highway. Fabric top is buttoned to top of the windshield for driving in wet weather.

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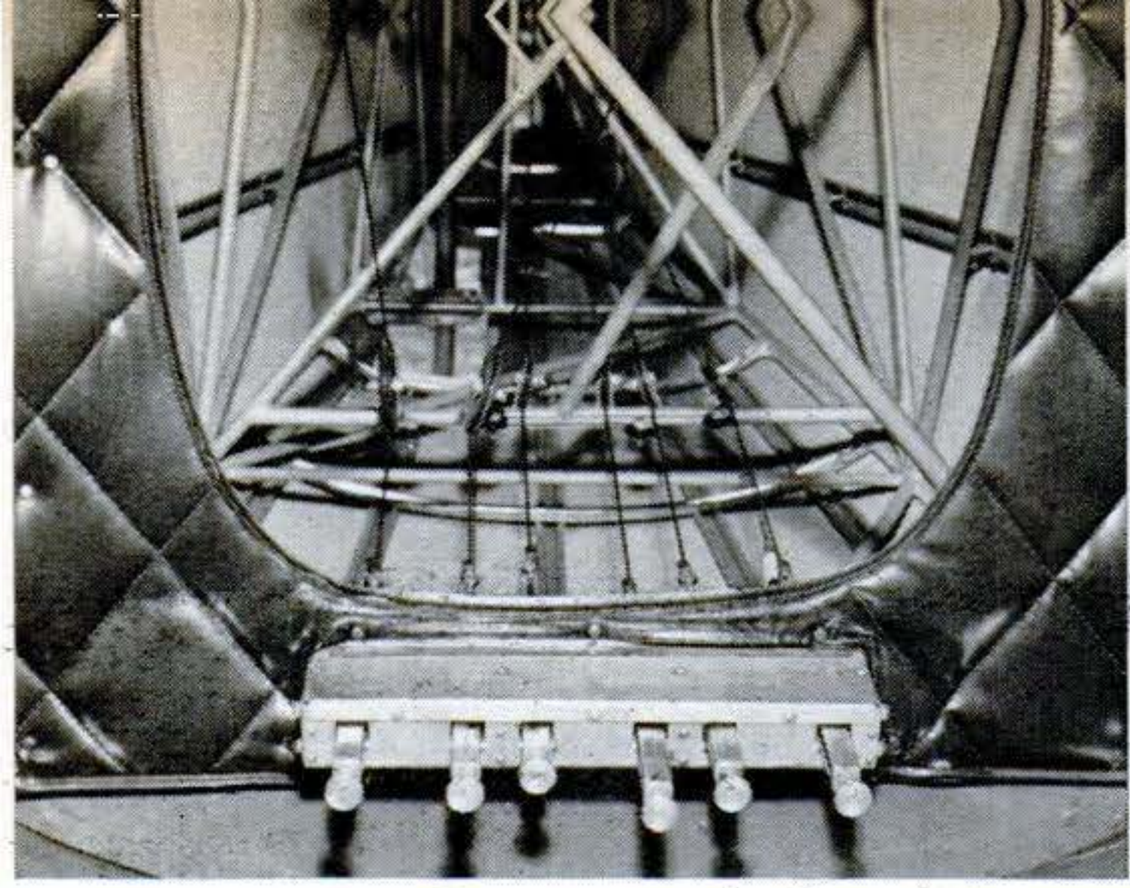
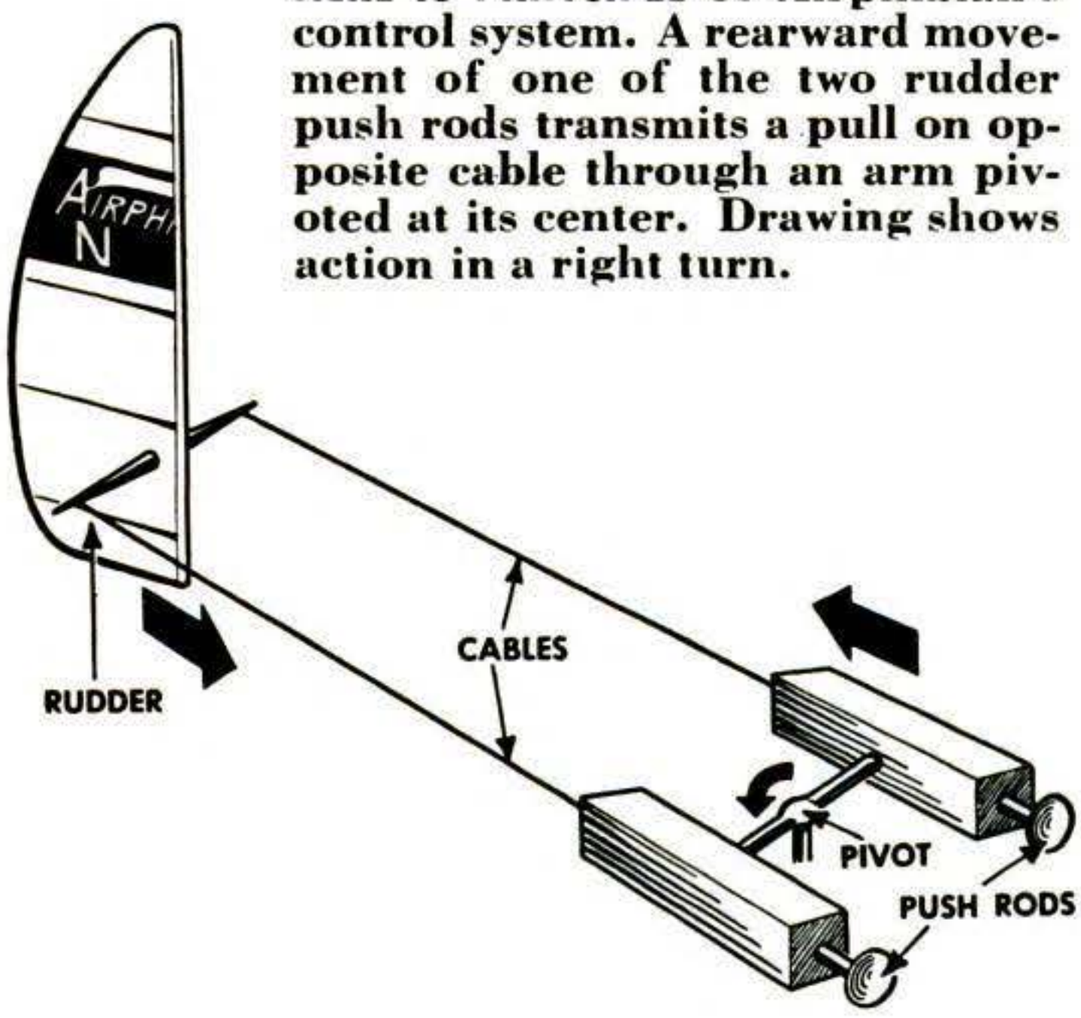


CONTROL LINKAGE between car body and fuselage is simple. When units are assembled, these six push rods in fuselage contact similar rods in car body, as shown at right above.

TWO RODS operate ailerons, two the rudder, two the elevator. But control cables can't be pushed; they must be pulled. How a push becomes a pull is shown in diagram at left below.

HERE IS PRINCIPLE of Airphibian's control system. A rearward movement of one of the two rudder push rods transmits a pull on opposite cable through an arm pivoted at its center. Drawing shows action in a right turn.



was a bit hard, slightly bumpier than that of a sports car. The reason was, of course, that the vehicle's springing was designed for the combined weight of all its components—the car, wings, fuselage and tail surfaces. When it is only a car, the suspension gets stiffer.

We found that the engine cowling—pardon, hood—was a shade too high for perfect downward visibility. But the handling qualities on the ground are superb. The lateral stability is amazing. You can take corners at a surprising speed.

Tread Is Wide

That's partly because of the wide spacing of the wheels—67 inches center to center. The tread has to be wide to give the Airphibian ample stability on the ground in landing and take-off runs when it's an airplane. Part of the stability also comes from individually springing all four wheels.

You sit higher in the Airphibian than you do in a conventional car. That's because the supports between the wheels and body must be long enough to give proper shock-absorber travel for cushioning landings when the Airphibian is an airplane.

That's about the only difference to the feel of driving, though. Your eyes, of course, must become accustomed to spotting the air-speed dial—beg pardon again, the speedometer—on the panel. And you must be alive to one real hazard on the ground. Every time you pull up at a stoplight other motorists gawk so hard that they're likely to get off course when traffic begins moving. Fulton's records show that in some 250,000 miles of traveling in the Airphibian during the proving trials, he and his test pilots have driven it on the highway seven times for every time they have flown it. But—and here's the pay-off—they have flown it 300 miles for every 100 miles they've driven it. It goes a lot faster in the air.

Hurry Up and Wait

Fulton got to thinking about his Airphibian during World War II when he was making gunnery trainers for airmen. He had a force of 40 field men to service the trainers all over the country and instruct budding airmen in their use. His field men, mostly pilots themselves, would sashay into an airport by plane and then spend a couple of hours trying to find ground transportation.

That's when he began getting mad.

"I kept saying to myself," he recalls, "that an airplane, after all, had what it took to be a land vehicle—an engine, wheels and controls. Why couldn't it be driven down the road?"

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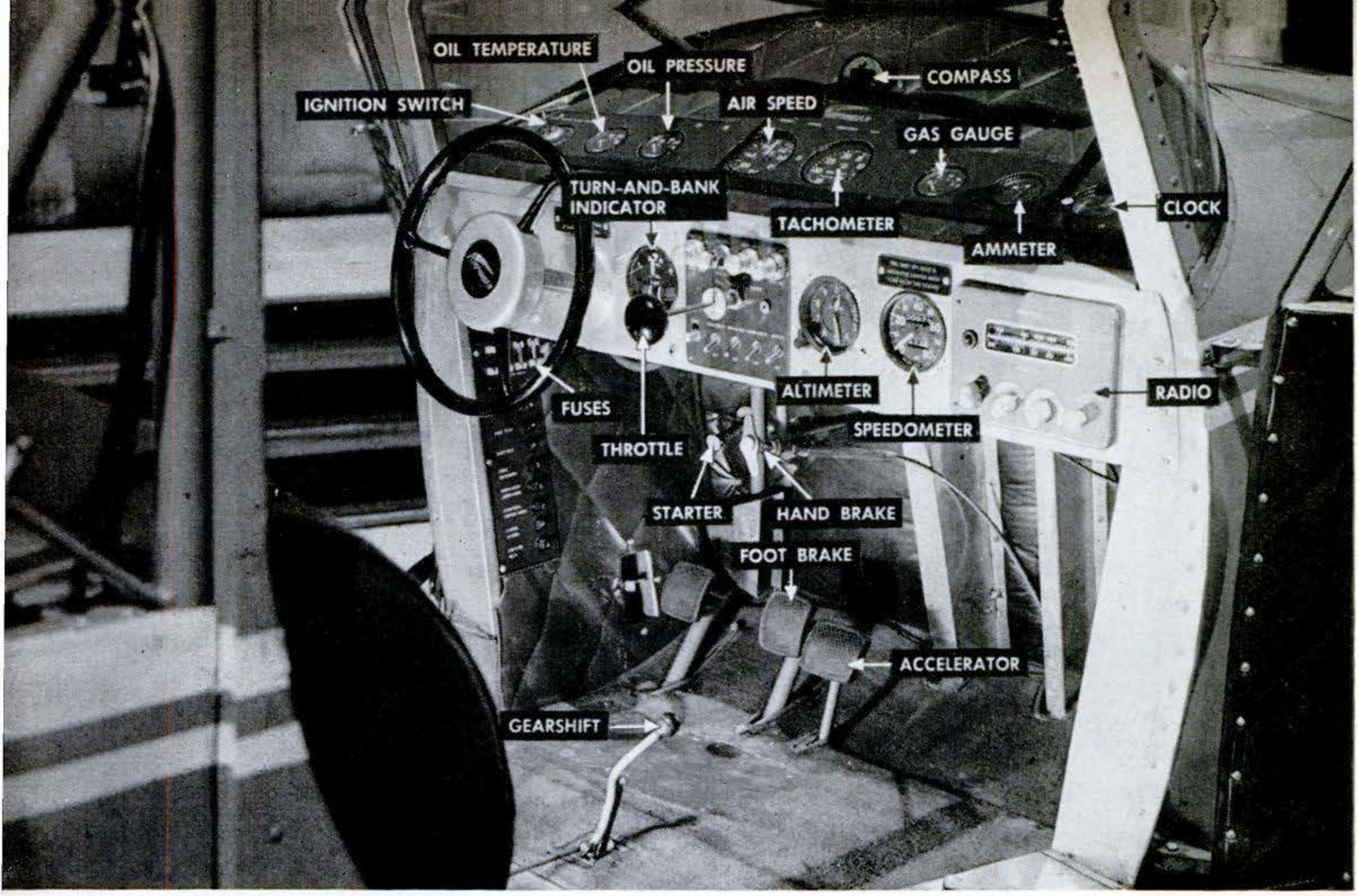

LOTS OF INSTRUMENTS. Not labeled above on throttle panel are engine controls, horn, and headlight, navigation and check switches. Wheel hides directional gyro and turn signals.

He had a host of problems to whip. He had to find a means of transmitting engine power alternately to a propeller and the rear wheels of his vehicle. How he gets it to the wheels is the only item on the Airphibian he won't discuss yet. We can disclose, though, that in his initial production models, to sell for between $10,000 and $15,000, the drive will differ completely from the one we saw. That's not because the present one isn't all right. For government engine certification, Fulton—no relation to the man who built the steamboat—drove the Airphibian as a car for 1,000 miles at an average of 40 miles an hour, so it works as it is.

[*Continued on page 240*]

FACTS ON FULTON AIRPHIBIAN

Model: FA-3 two-seater.

Engine: Franklin air-cooled 6-cyl. valve-in-head, horizontally opposed; 150 hp. at 2,600 r.p.m.; compression ratio, 7 to 1; piston displacement, 335 cu. in.; bore and stroke, 4½" by 3½"; crankshaft bearing surface, 38 sq. in.; torque, 302 lb.-ft. at 2,600 r.p.m.

Brakes: disks with "spot" contacts.

Suspension: independent rubber torsion mounts on four wheels.

Inside dimensions: seat-cushion width, 34"; leg room, 47"; headroom with top up, 36"; seat height, 11"; vertical distance, steering wheel to seat cushion, 7½"; seat adjustment, horizontal none, vertical about 3".

Tire size: 6.00 by 6.

As a Car

Piston travel: (in feet per car mile at 20 m.p.h.) 658.

Weight: 1,120 lb.; per hp., 7.5 lb.

Transmission: unannounced.

Steering ratio: 4 turns lock to lock; radius of turning circle, 18 ft.

Outside dimensions: height, 66"; over-all length, 132"; width, 72"; wheelbase, 72"; overhang, front 24", rear 33"; tread, front and rear, 67".

Speed: 50-60 m.p.h.; fuel consumption, 20 m.p.g.

As an Airplane

Weight: (empty) 1,520 lb.; per hp. (power loading), 10.1 lb.

Transmission: ungeared 3-bladed, fixed-pitch Sensenich propeller.

Outside dimensions: height (to top of vertical stabilizer), 92"; over-all length, 201"; wing span, 408".

Wing area: 152 sq. ft.; wing loading, 13.8 lb. per sq. ft.

Rate of climb: 585 ft. per min.

Speed: 110 m.p.h. cruising; fuel consumption, 8 gal. per hr.

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Radar Plotter Aids Pilot

EVEN ships with radar have collisions—too many of them. But a new device is expected to eliminate much of this danger. Until now the navigator has had to transfer radar readings to a chart in another room, a time-consuming process offering many chances for mistakes. With Raytheon's radar plotter, he can mark the path of a nearby ship on a plastic sheet directly over the scope. A tricky optical system eliminates any error caused by the fact that plastic sheet and scope face are several inches apart.

Deaf Dog Hears Again

WHEN 14-year-old Laddie lost his hearing, his owner built him a battery-powered hearing aid. Worn around the neck like a St. Bernard's keg, the device functions like a public-address system. Sound is picked up by a microphone, then amplified and transmitted through an earpiece. The cocker spaniel's master, Phil Savage of Huntington Park, Calif., turns the aid off each night, on again in the morning. Unlike a human who can switch off his own hearing aid, Laddie must listen to scoldings.

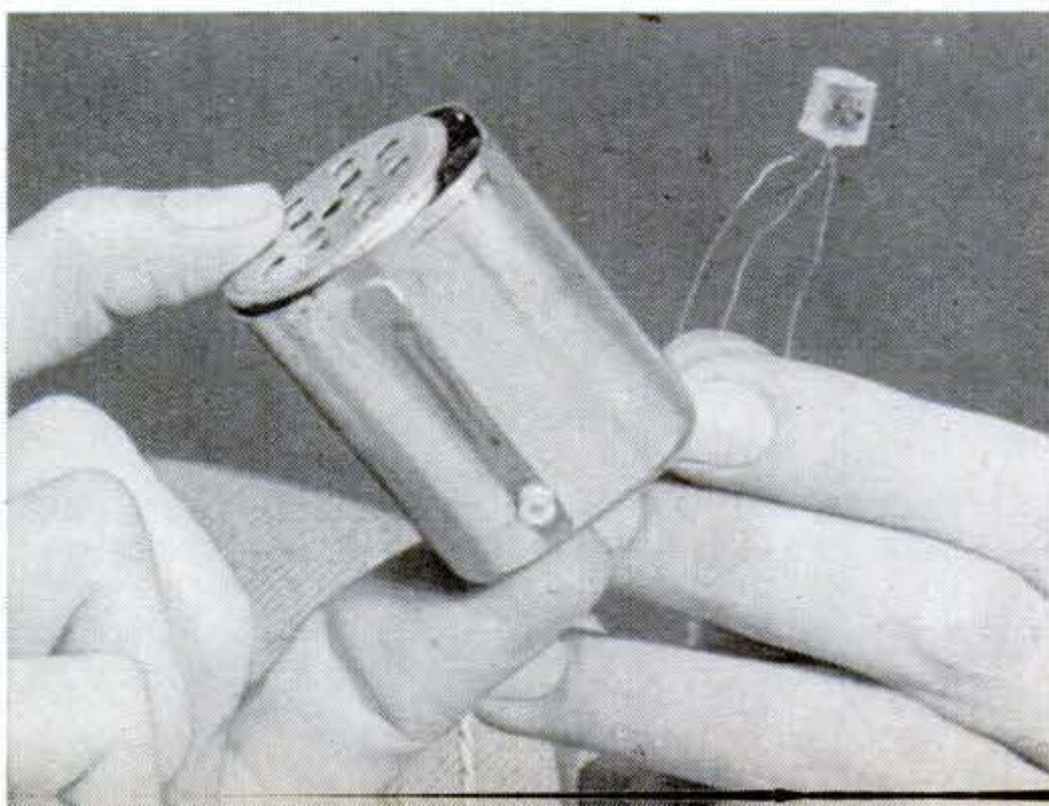
New Cycle Has Self-Starter

POLICE on the parking-meter beat will have an easier job with this new motorcycle. It has a push-button self-starter, three forward speeds, and a reverse to simplify maneuvering in tight spots. Chain drive has been replaced with a shaft.

Indian claims that a policeman can learn to ride the three-wheeled Patrol more quickly than a two-wheeler, and that it is safer. The box between the two rear wheels is an emergency seat for two men, and carries guns, lights, first-aid kit and other equipment.

Radio Station Fits in Pocket

THE new radio transmitter below may not fit in a wrist watch, but it's not much bigger than a pocket lighter. Secret of the small size is a tiny germanium-crystal transistor, shown at right. Replacing an amplifier tube, the transistor uses minute amounts of power, enabling the set to run on a miniature dry cell inside the case. The transmitter, which has a range of several hundred feet, is an experimental unit made by Everett Read of the General Electric Electronics Laboratory, Syracuse, N.Y.



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MEMO to GIs the world over: They're slicking up the jeep for you.

When you get your hands on the newest version of the famous old four-by-four—known as the jeep in any language, including Hindustani—it won't jounce you around quite so much; it will go a little faster—about 70 instead of 65; it will have some curves where all those angles were.

You'll have a little more room for your feet, and when you raise the hood you won't risk having the darned thing fall on your head. The car will be easier to start when the mercury slides to zero.

Remember how you cussed out all the strapped-on stuff that caught branches on narrow roads? Well, the sides are smooth now. No more projections. And bet you can't guess what they did with the shovel that used to hang on the side—it's on a bracket inside the hood.

You've had your troubles working on the

STREAMLINING has come to the jeep—and its driver. Note new curves (the hood and fenders, we mean) and recessed headlamps. The body (jeep) is longer, wider.

Fancied-up, it's still the same combat vehicle that has toted presidents and fighting men from Guadalcanal to the Elbe.

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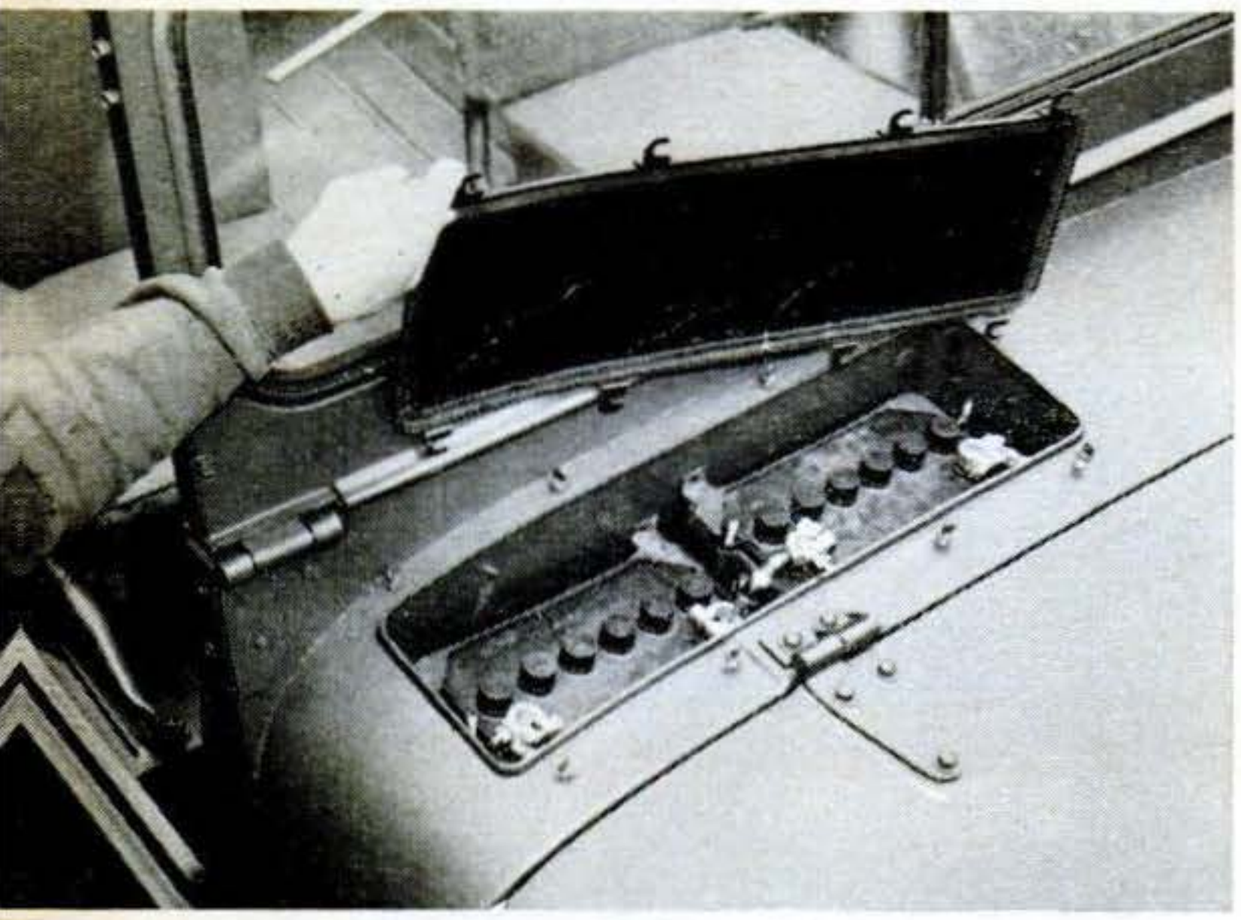
ARCTIC-STATIONED GIs will appreciate windshield defrosting supplied by hot-air inlet holes seen above dash. Handle at right is to prevent losing passenger on curves.



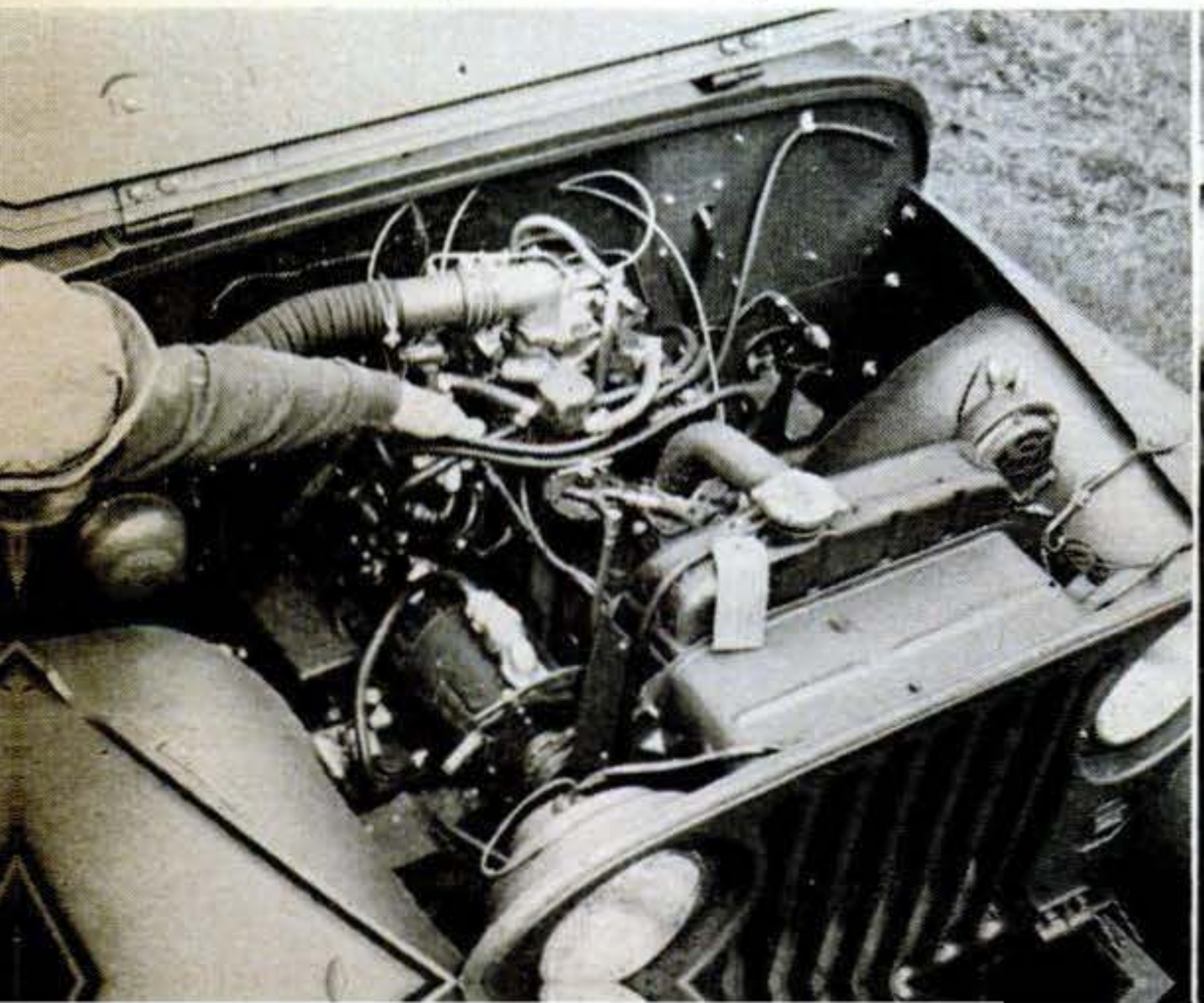
BOTH BATTERIES of 24-volt electrical system, boosted from the six volts of World War II jeep, are sunk in a cowl compartment. Formerly one battery rode under the hood.

innards of the jeep, in that little engine compartment. You can relax, soldier. The designers have come along and given you a lot more elbow room under the hood. Measures 24 inches deep by 33 inches wide. Now you can really get at the thing with a wrench.

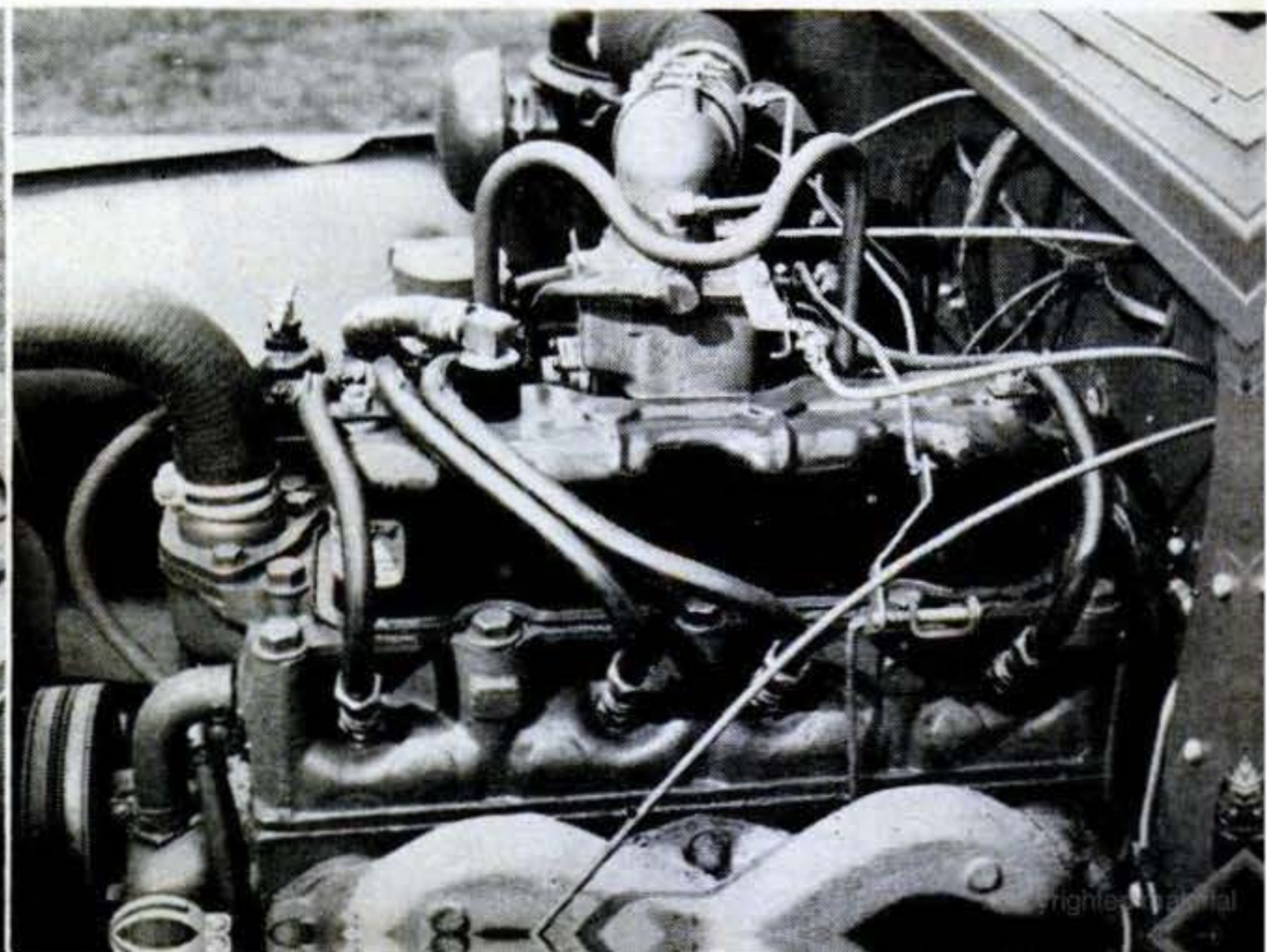
How many times has the guy riding in the right-hand seat searched for smoking words to describe a motor vehicle, government-issue, without automatic wipers on both sides of the windshield? The new jeep's got 'em.

And remember those shocks? Get on a washboard road with the old jeep and, after the first bump, it was just like not having any shock absorbers at all. They "faded," as the engineers say. Well, that's been mended, too. New shocks. They'll go on for hour

WATER doesn't bother the engine. Mechanic's hand points to the new waterproofed ignition harness. The clutch and transmission also have an improved waterproofing treatment.



ENGINE IS AN F-HEAD, meaning that intake valves are in the head, and exhaust valves at the side as in an L-head. This raises horsepower from 60 to more than 70 at 4,000 r.p.m.



STEEP HILLS never fazed a jeep, but the new one takes them more easily. Other improvements include: bigger brakes, softer pedal action, steering ratio upped from 15.3 to 19 to 1.

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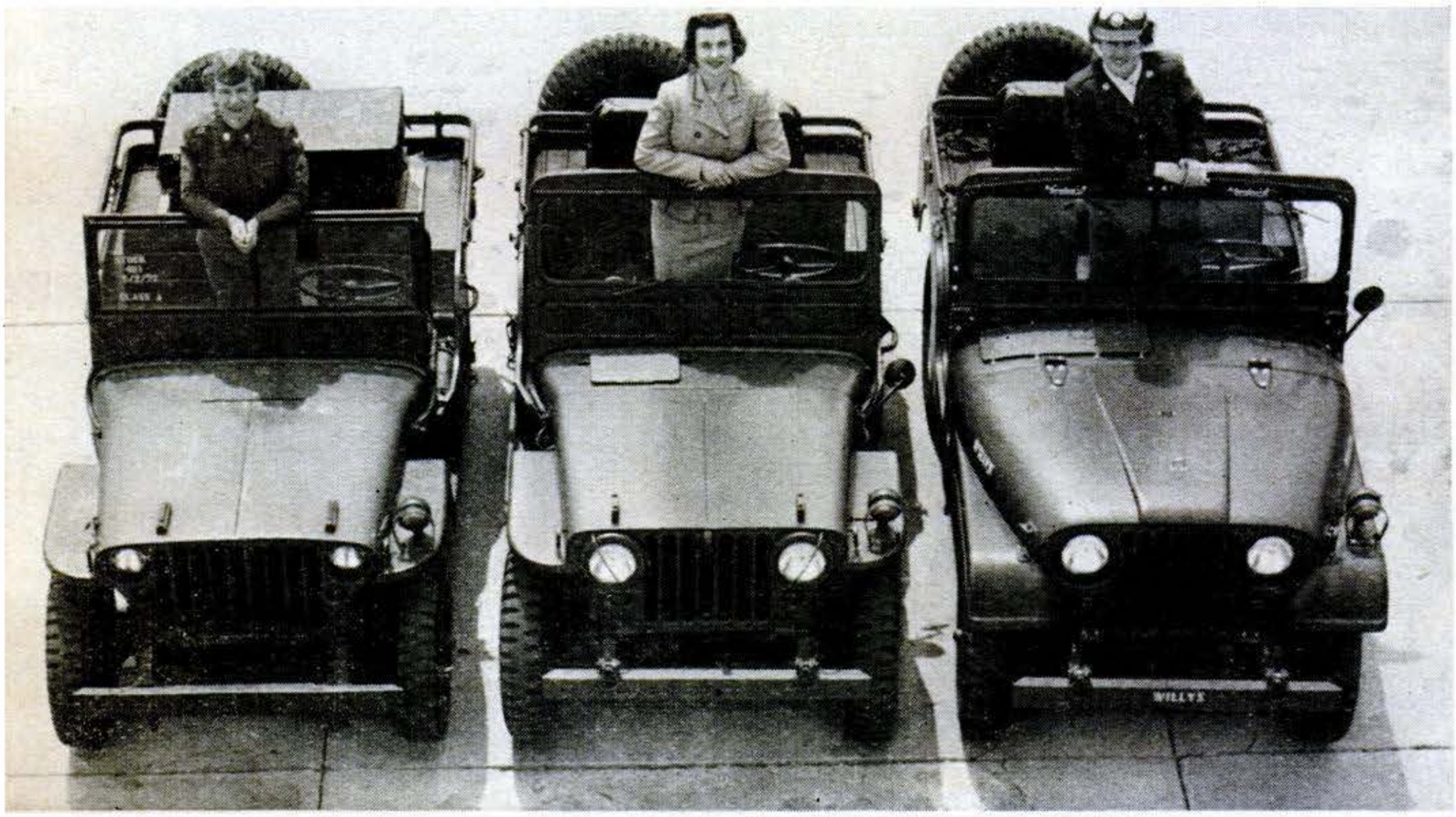
SNORKEL permits engine to breathe while fording a stream. Pressure built up in crankcase to keep water out is now bled to bell housing and transmission to do same job there.

after hour smoothing out the bumps. And the seats have softer springs and are covered with plastic instead of fabric.

Remember the time you accidentally hit the light switch under blackout conditions and the brights came on? Well, the sergeant can't eat you out for that one anymore. They've put the light controls behind the steering column, out of the way. And you don't have to be a contortionist to reach both primer and choke at the same time for cold-weather starting. They have been placed one on either side of the steering column. The cable type of emergency brake on the dash has been replaced by a ratchet type between the front seats. All steering tie rods have been beefed up and the four universal joints on the two drive shafts are, for the first time, sealed and lubricated for the life of the vehicle.

Guess that about buttons it up—except that the compression ratio is upped from 6.5 to 6.9 to 1. Willys-Overland Motors, in Toledo, which turned out many of the hundreds of thousands of World War II jeeps, says this new one is really the fourth generation of the four-wheel-drive quarter-ton truck (that's what the Army calls it). The one you probably know best was the second generation. The third-generation jeep came out in 1950. It included some modifications and was called the M38. Now Willys is starting production on this new one, to be known as the M38A1.

Whatever designation it bears, it will still be a half-pint truck in olive drab. You didn't join the Army to ride around in Rolls-Royces, soldier.—*Devon Francis.*



JEEP'S EVOLUTION is shown above starting with famed World War II model (left) that was recently exhibited by New York's Museum of Modern Art as one of eight automobiles selected for their excellence as works of art (PSM, Nov. '51, p. 161). Postwar development of M38 (center) led to bigger, streamlined job (right). Is the new jeep as pretty? No, lamented the Museum's Director of Architecture and Design: "A typical case of styling—and ugly styling at that—ruining a good, clear example of machine art. It is the usual case of bloating used to make cars look bigger by adding unnecessary curves."

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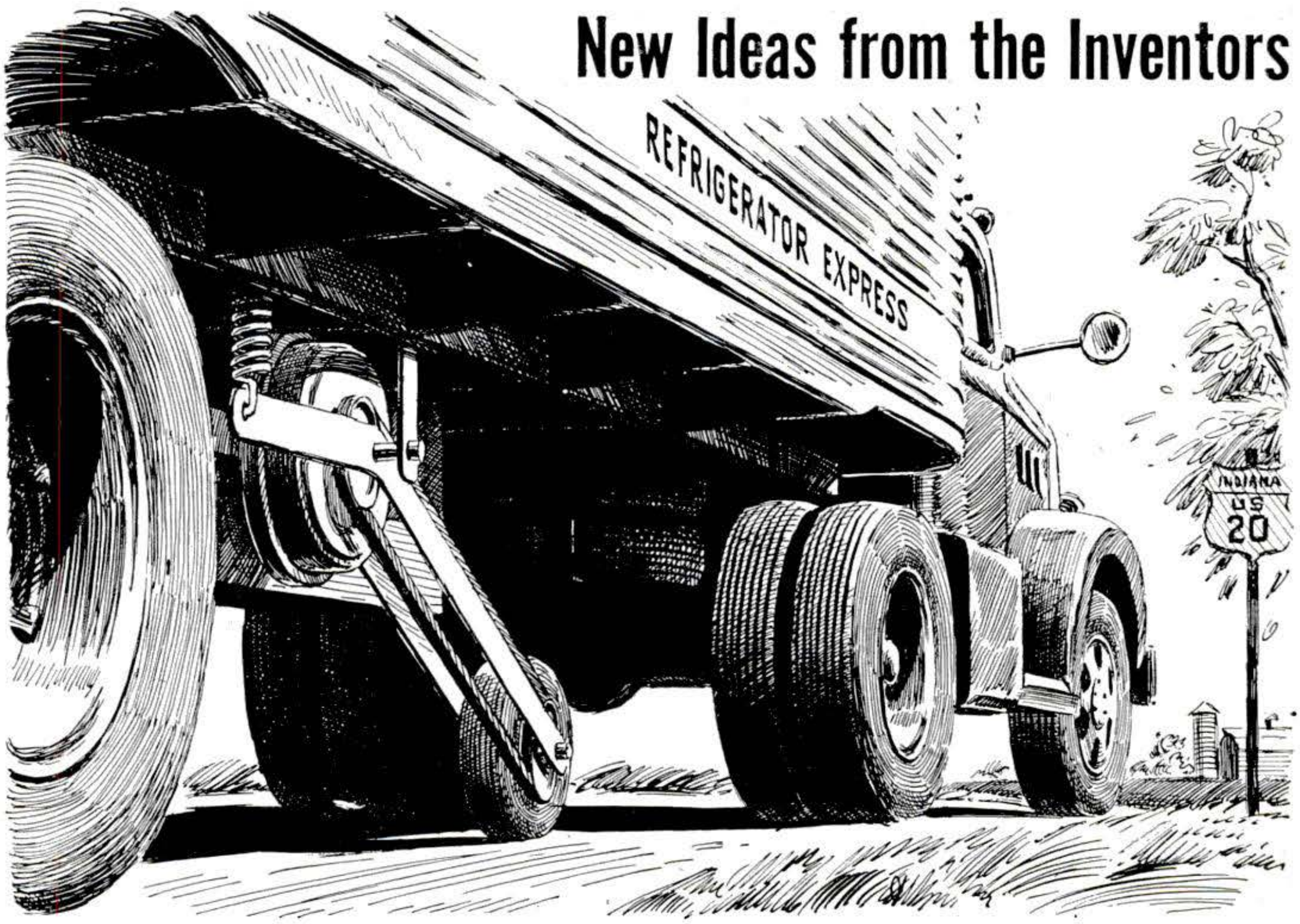
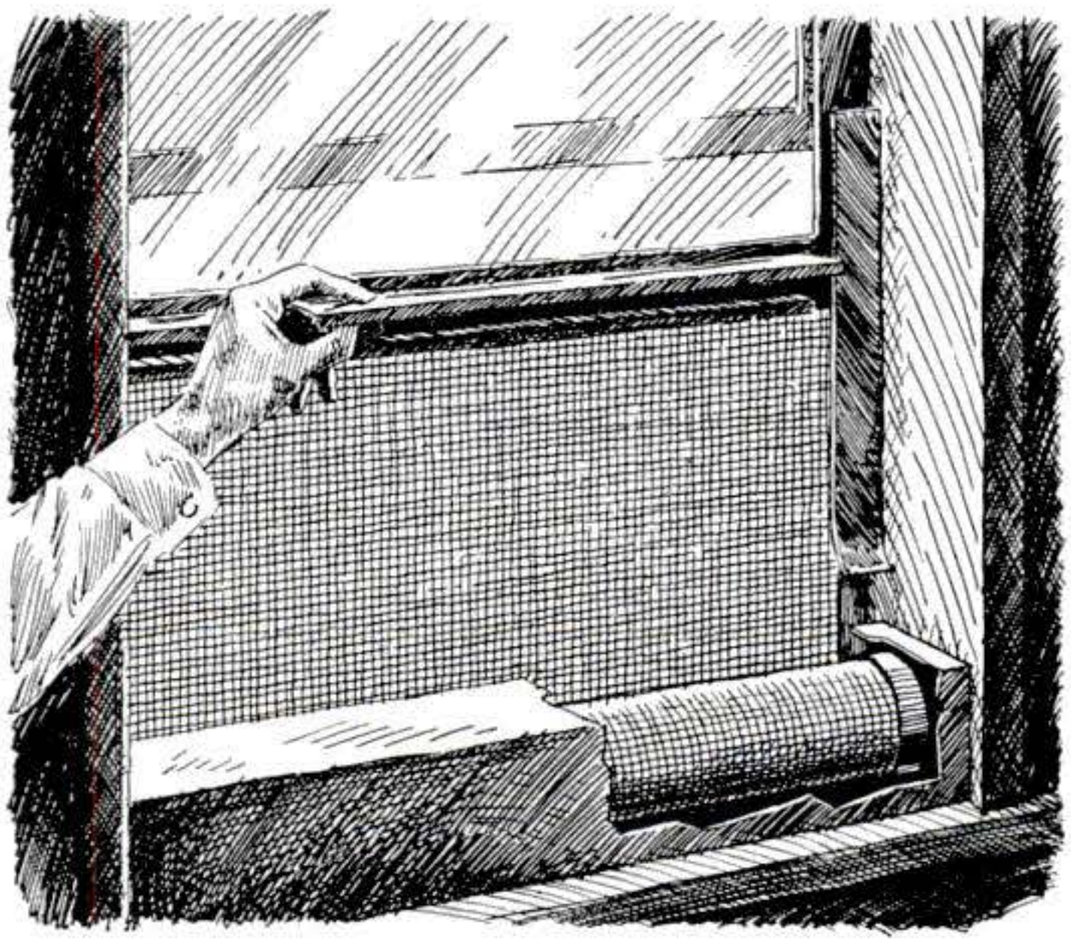
New Ideas from the Inventors



1 Wheel to Power Refrigerator. Perishable produce could be kept safe by the truck engine's power with a trailer like this. An extra road wheel would drive a compressor through an electric clutch. Actuated by a temperature control, the clutch would engage or disengage the compressor. An auxiliary electric motor that could be plugged in anywhere would take over when the truck stopped.



2 Screen to Open With Window. This roller screen would let in more light on gray days when the window was closed or partly open. One end of the screen would be attached to a spring roller, the other to the sash bottom. As the window opened, the screen would rise in fitted guides and be held up by the window counterweight.

3 Bottle Cap to Time Medicine Doses. You would be less likely to forget to take your pills on schedule if the bottle had a reminder cap. Each time you took a dose you would set this pointer to the time when the next one was due. Closing the bottle would lock the pointer at its setting.

Please turn the page for more new ideas.

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MORE New Ideas from the Inventors

4 Deflector to Stop Car Drafts. This plastic air conditioner would shield the head and face of a back-seat passenger from air blasts. Clipped into a side window, it would move air downward, providing indirect circulation throughout the car.

5 Sharpener to Point Crayons. Soft crayons get blunt quickly but your youngster could make them good as new with this sharpener. Flat blades would shave the wax to a uniform taper while a separate cutter peeled the paper jacket.

8 Inner Door to Save Cold Air. Letting warm air into the refrigerator every time you open the door increases your food-storage bill. On this refrigerator a sliding inner door would seal off part of the box. Items stored on covered shelves would be kept colder at lower cost.

9 Mold to Shape Hamburgers. You could always be sure your hamburgers would fit the buns if you made them with the help of this mold. The inventor also points out that pressing meat down onto a hot grill sears it quickly and enables it to retain more of its juices.

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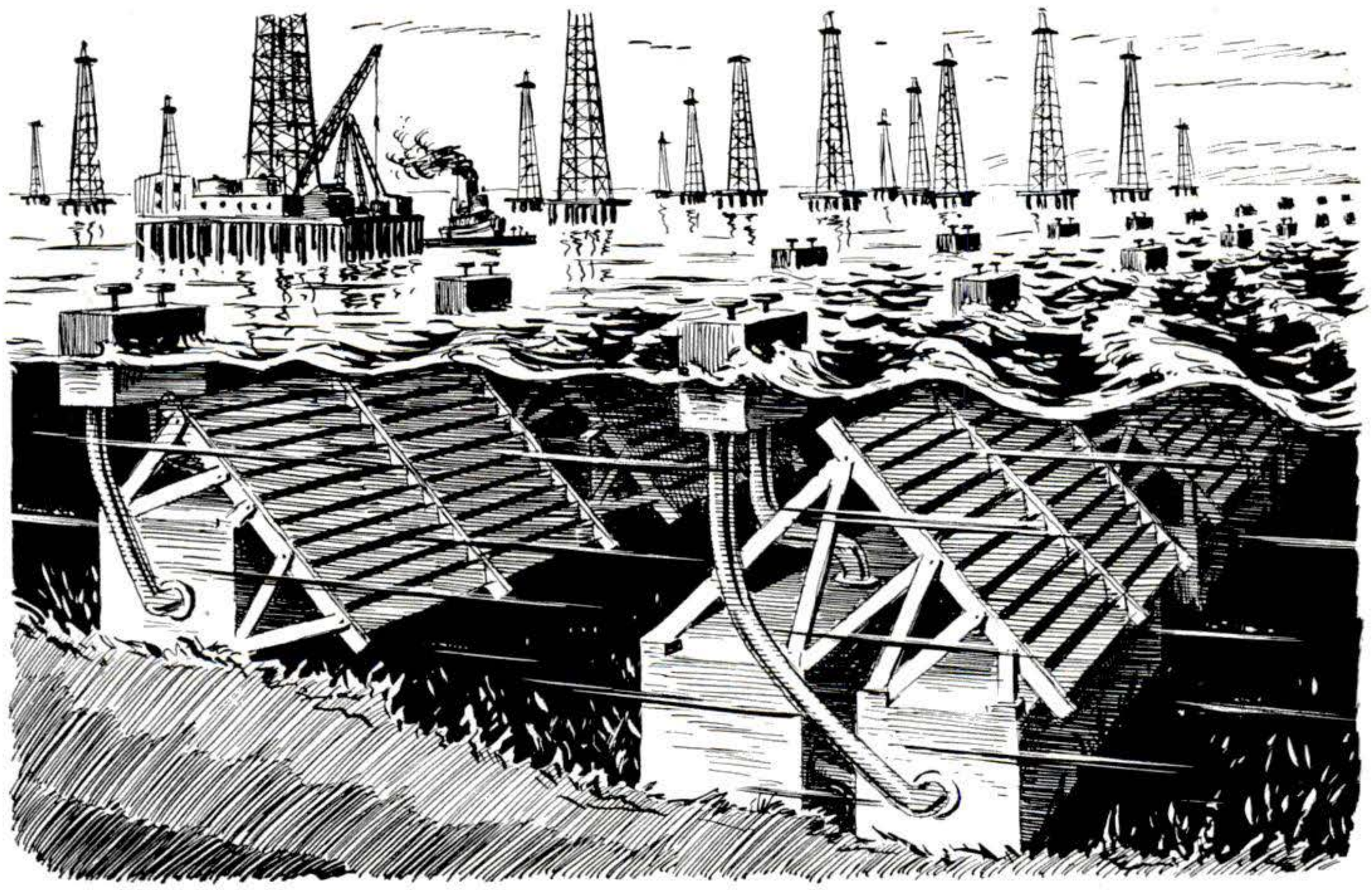
6 Square to Mark and Measure Wood. A channel in one leg of this try square would form a track for a pencil holder. The spring-retracted pencil could be moved along the scale, then pressed down to make an accurately measured mark.

7 Saddle to Hold Radio. A lone ranger might not feel so lonely if he had a radio with him. A reinforced pommel on a western-type saddle would hold this receiver. The antenna would be taped to a stirrup strap and batteries would go in a pouch.



10 Breakwaters to Guard Ocean Wells. These floatable wave breakers could be towed out to protect offshore oil-drilling rigs. Since finished wells need less protection, some of the breakwaters could later be re-used on the other jobs. Water would be pumped into the pontoons to anchor them, pumped out to refloat them.

Patents on these inventions have been granted to: 1. D. Tiffany, Great Falls, Mont.; 2. H. Renton, Germantown, Pa.; 3. H. Guion and E. Arnold, Los Angeles; 4. H. Riggs, Louisville, Ky.; 5. F. Swinehart, Strongsville, Ohio; 6. B. Boston, Pine Wood, S. C.; 7. E. Rovere, San Francisco; 8. G. Kuchler, Brooklyn; 9. A. Belt, Bloomington, Ill.; 10. P. Guarin, Houston.

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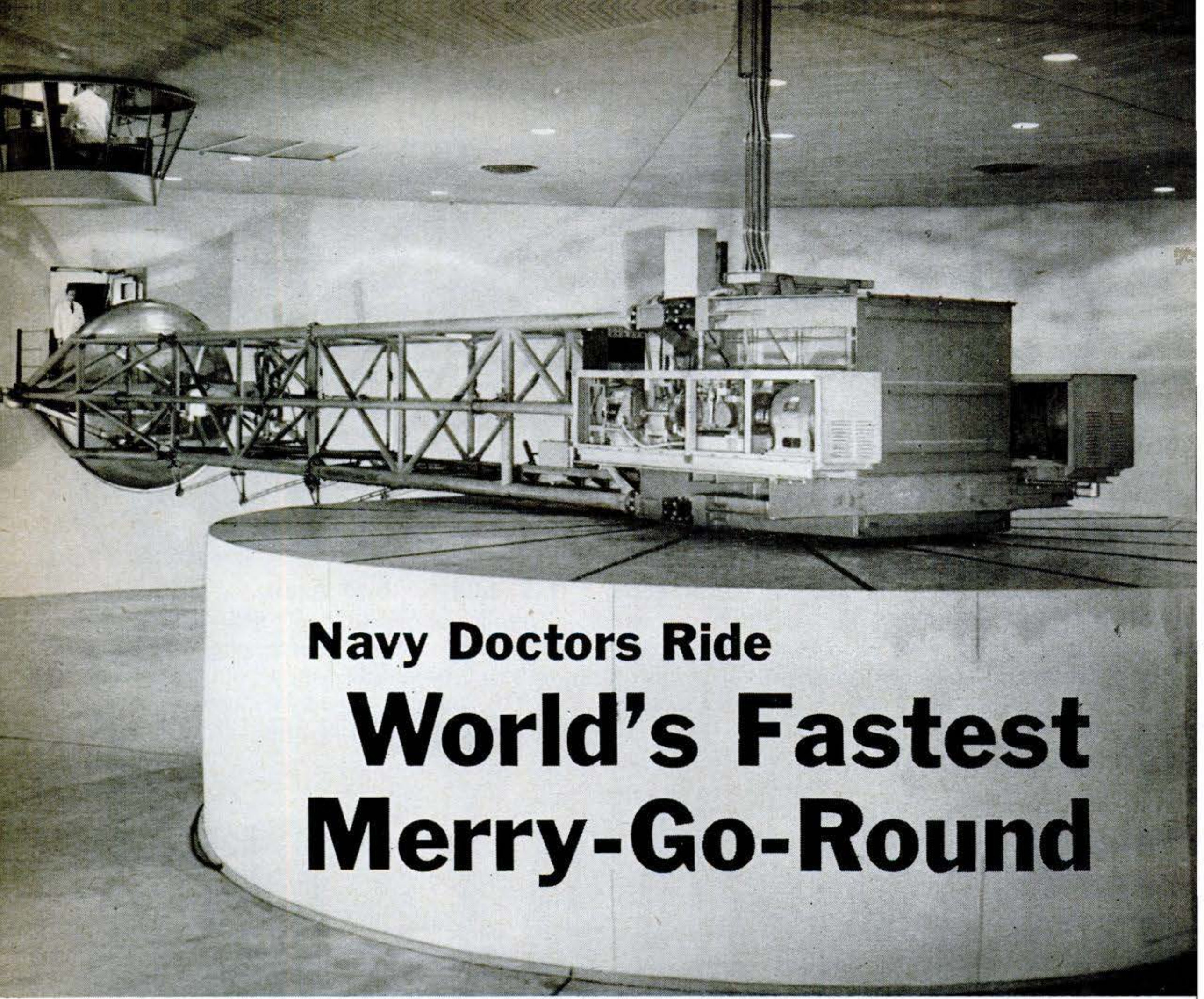

Navy Doctors Ride

World's Fastest Merry-Go-Round

Arm of human centrifuge has gondola at one end, 35 tons of steel counterweight at the other.

The brass ring they're reaching for is the information that will let men and machines safely fly faster than ever before.

By Herbert O. Johansen

IN AN open field amid the peaceful, rolling country of Bucks County, Pa., a small carnival had pitched its stand. The shrieks of delighted youngsters competed with the wheezes and groans of an ancient merry-go-round. It wasn't very fast, but the riders on the outer rim experienced a pleasant emptiness in the pits of their stomachs.

Not far away stood a white, circular building of modern design. Within its walls whirled a very different kind of merry-go-round, one of the most fantastic tools of scientific research—a human centrifuge that can spin a man-carrying gondola up to a speed of 174 miles an hour in less than seven seconds, exerting G forces that could tear the occupant's insides apart.

The white building is the new $5,000,000 Aviation Medical Acceleration Laboratory of the Naval Air Development Center at Johnsville (PSM, Feb. '48, p. 98), which was opened last month. Its core is the monster merry-go-round, a 50-foot tubular-steel arm. When whirled by a 4,000-horsepower, 180-ton electric motor, its gimbal-gripped aluminum gondola reaches a top speed of 48½ revolutions a minute, subjecting an occupant to an acceleration rate of 40 G. (One G is the normal acceleration of gravity; at 40 G, there would be 40 times the normal pull on the blood, internal organs and all other parts of the body of a gondola occupant.)

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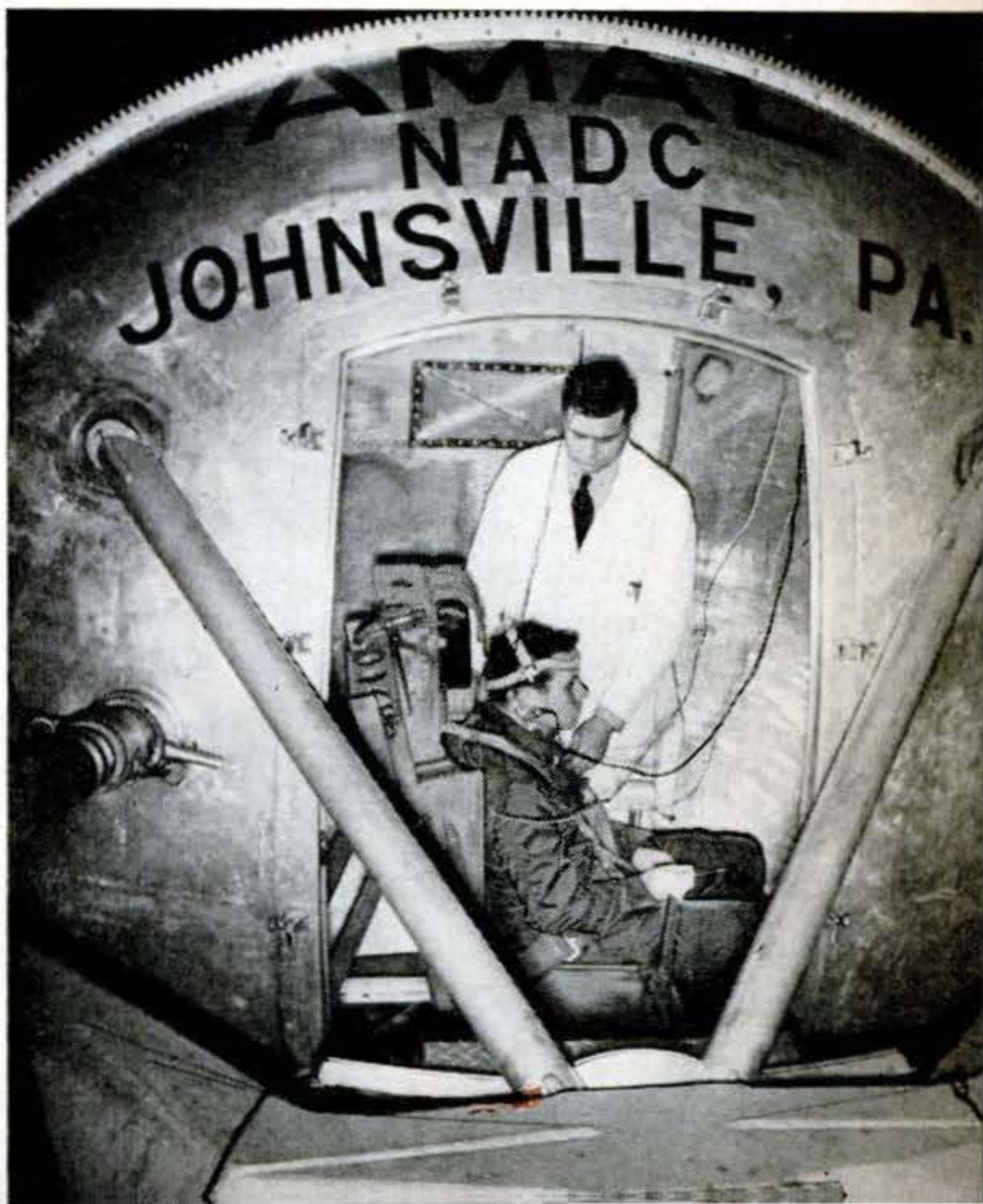
A G-RIDER, wired so his physiological reactions can be measured, enters the centrifuge gondola from wall-port loading platform. At far left is Commander C. F. Gell, Acting Director of the laboratory. Below, Lt. James E. Ziegler makes final adjustments before a spin.



Altitudes up to 60,000 feet can be simulated by pumping air out of the gondola.

The Navy doesn't plan to spin human beings at such high G forces at present, but the delicate instruments of guided missiles and rocket weapons have to take such strains today. This is their test bed. But the time may not be far off when men will have to stand such terrific, torturing acceleration during violent climbs, dives or turns in super supersonic airplanes and manned missiles—or before space flight with passengers becomes a reality.

The new centrifuge was designed to give scientists a short cut to the answers of how to live with high G forces. To yield a true picture of what happens during shock-packed acceleration in actual flight, the centrifuge must be able to wind up to its

dizzy whirl fast. Today's faster-than-sound planes develop G forces in a hurry.

It took almost five years to build the centrifuge because nothing just like it had ever been built before. The 10- by 16-foot aluminum gondola is shaped like a flattened sphere—technically, an oblate spheroid. It had to be hammered to shape practically by hand as there was no machine that could do the job. Another problem was the design of the gimbal system that enables auxiliary hydraulic-electric motors to control the gondola in all positions during a spin.

Gondola Carries 600-Pound Load

A payload of 600 pounds (that means 24,000 pounds at 40G) can be carried in the gondola. This load may consist of a man or a monkey (the monkey may have plastic windows in its skull so that observers can watch the flow of blood and brain fluids), plus television and movie cameras, high-speed moving-picture X-ray equipment, and various delicate sensing and measuring devices that record body reactions.

These reactions are recorded electrically on moving strips of paper in a room above the centrifuge chamber, where television screens also are located to show a live, running picture of the subject's facial and muscular reactions during a speed spin.

The whole operation—from the siren that blows to announce the start of a run to the air-braking, which, with the aid of two electric eyes, brings the gondola to a stop lined up with the wall-port loading platform—is controlled from a glass-enclosed blister hanging down into the centrifuge room.

Cams Control Spin Pattern

The complex pattern of the 40-second run, with speeds varying and gondola positions changing, can be controlled by three cams—one for radial speed and two for gimbal positioning. These cams, which can be cut to set up any desired conditions, are "played" on a special turntable like a phonograph record.

The gimbal motors' control circuits and the wires that carry running reports of reactions during a spin are linked to the observation and control stations through slip rings on the vertical rotor shaft. There are 52 of these rings, 22 for power and 30 for picking off physiological data. While brass is good enough for the power rings, the physiological-circuit rings require a combination of metals to eliminate all possible electrical interference. Some of the more critical rings are brass plated with silver, then coated with palladium and a final plating of rhodium.

Static and magnetic interference was another problem that had to be licked. It was done by shielding the entire 110-foot-diameter centrifuge chamber—walls, floor and ceiling—with 1/16-inch copper. To baffle electrical interference from the motor, the base of the gondola arm pivots in a trough of mercury.

Set in a circle around the centrifuge chamber is a series of research units: physiology, biophysical, biochemistry and gas analysis, pathology, and electronics laboratories.

Keeping Ahead of Plane Designers

"For the first time," explains Commander C. F. Gell, USN Medical Corps, Acting Director of the centrifuge center, "we will be able to gather information on actual performance in the realm of G forces. Previously, the study of human reactions in aircraft has always lagged behind the accomplishments of the aircraft designers. Now that situation is reversed."

Some of those youngsters on the carnival merry-go-round may grow up to exchange a gaudily painted, bouncing wooden steed for the pilot seat of an as-yet-undesigned jet or rocket plane. Then, thanks to the Big Wheel at Johnsville, they'll be able to fly a lot faster a lot safer. END

THIS IMPOSING BUILDING was designed specially to house the Navy's new acceleration laboratory. The human centrifuge itself was constructed by McKiernan-Terry Corp.

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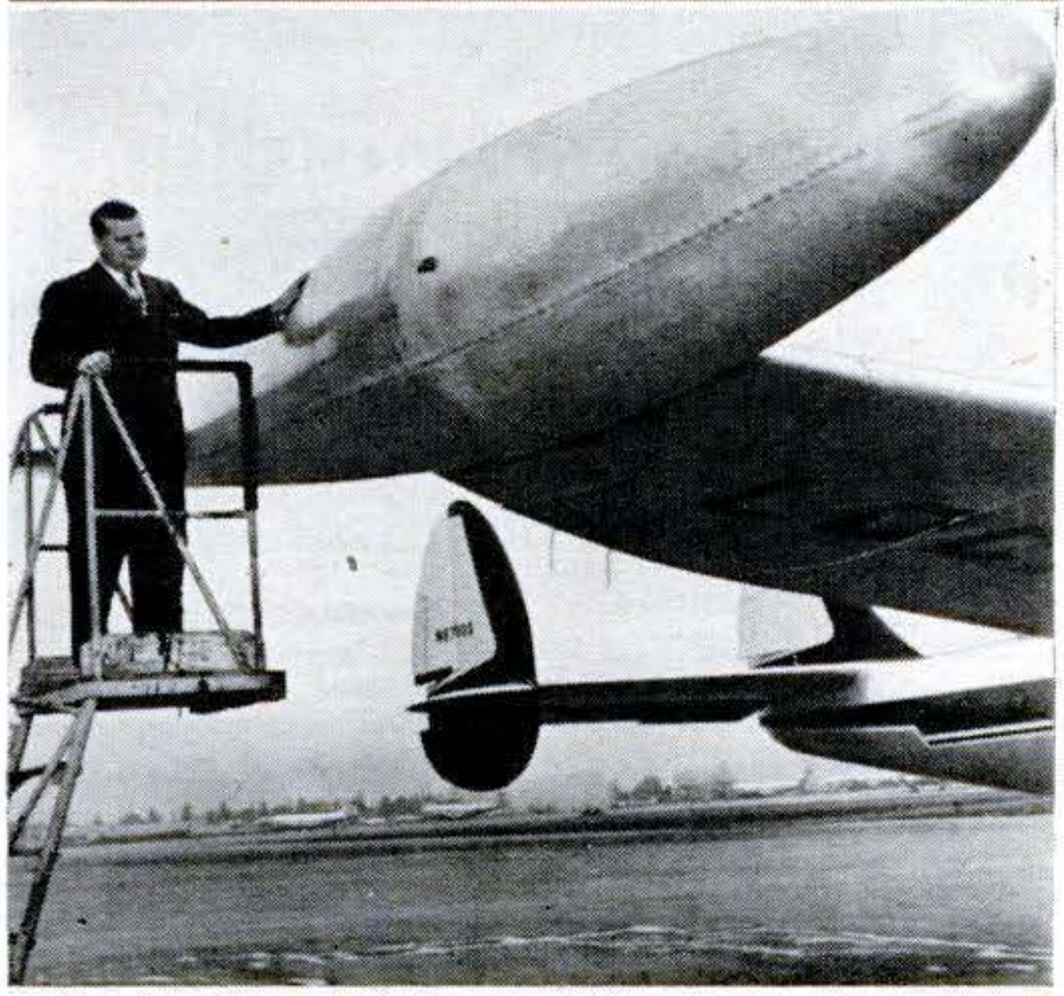


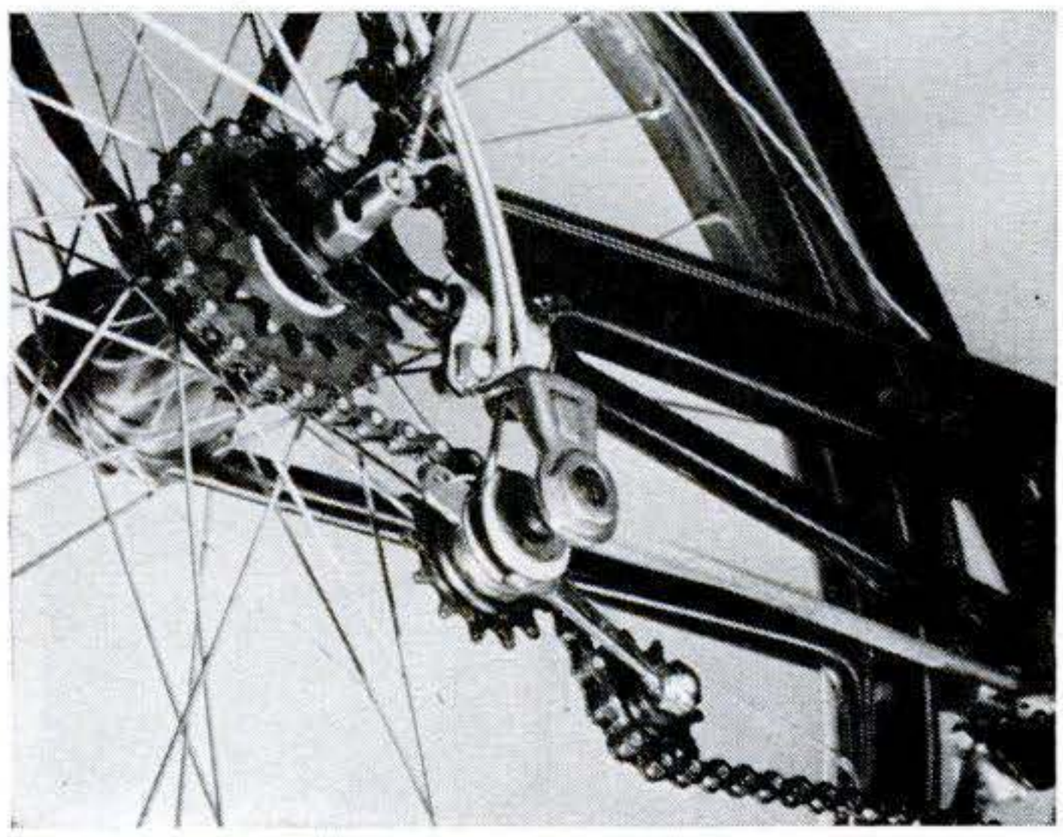
Transport Gets Wing Tanks

THE first transport to fly with wing-tip fuel tanks is the Super Constellation test plane pictured above. Previously used only on fighters, the tip tanks will be standard on turboprop-powered Super Connies now on order for the Navy. Each tank will hold 600 gallons of fuel to give the 450-mile-an-hour Lockheed plane long range, even though its new engines eat up 50 percent more fuel than the conventional ones.

When commercial turboprop air liners are built, the tanks will make possible non-stop flights from Shannon, Ireland, to New York. Each tank develops enough lift to compensate for the weight it adds.

Hill-Climbing Gear Gets Six Speeds Out of Three-Speed Bicycle

EVEN mountains aren't too much for bicyclists using the gear-conversion unit below. It is designed to improve the hill-climbing ability of bikes having three-speed transmissions by doubling the number of speeds available. It can also be used to provide a second gear on a standard bike.



The unit consists of a large sprocket for the rear-wheel hub and two idler sprockets that form a clutch. A hand control moves an idler sprocket sideways to shift the bicycle chain between the regular rear-wheel sprocket and the large sprocket, giving an extra speed for each one built into the bike. Made by the Cycle Gear Co. of Birmingham, England, the unit is marketed here by Dawes Distributors, Cambridge, Mass.

Coated Eyeglasses Aid Pilots

SPECTACLE-WEARING Air Force pilots can now see better at night. Their goggle-size eyeglasses are coated with magnesium fluoride, like fine camera lenses, to cut down reflection and loss of light.

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What's New on Radio Row

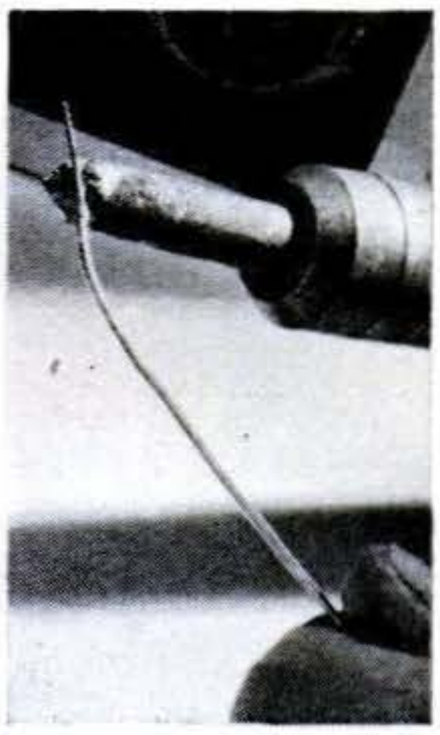
TV Safety Mask Snaps Off

THE safety glass and decorative bezel can be removed from the front of this Emerson receiver so that the set owner can wipe picture-dimming dust and soot off the glass and tube face. No tools are needed to take off or replace the front. Cabinet catches hold the bezel securely when it is snapped back.

Amplifier Improves TV Sound

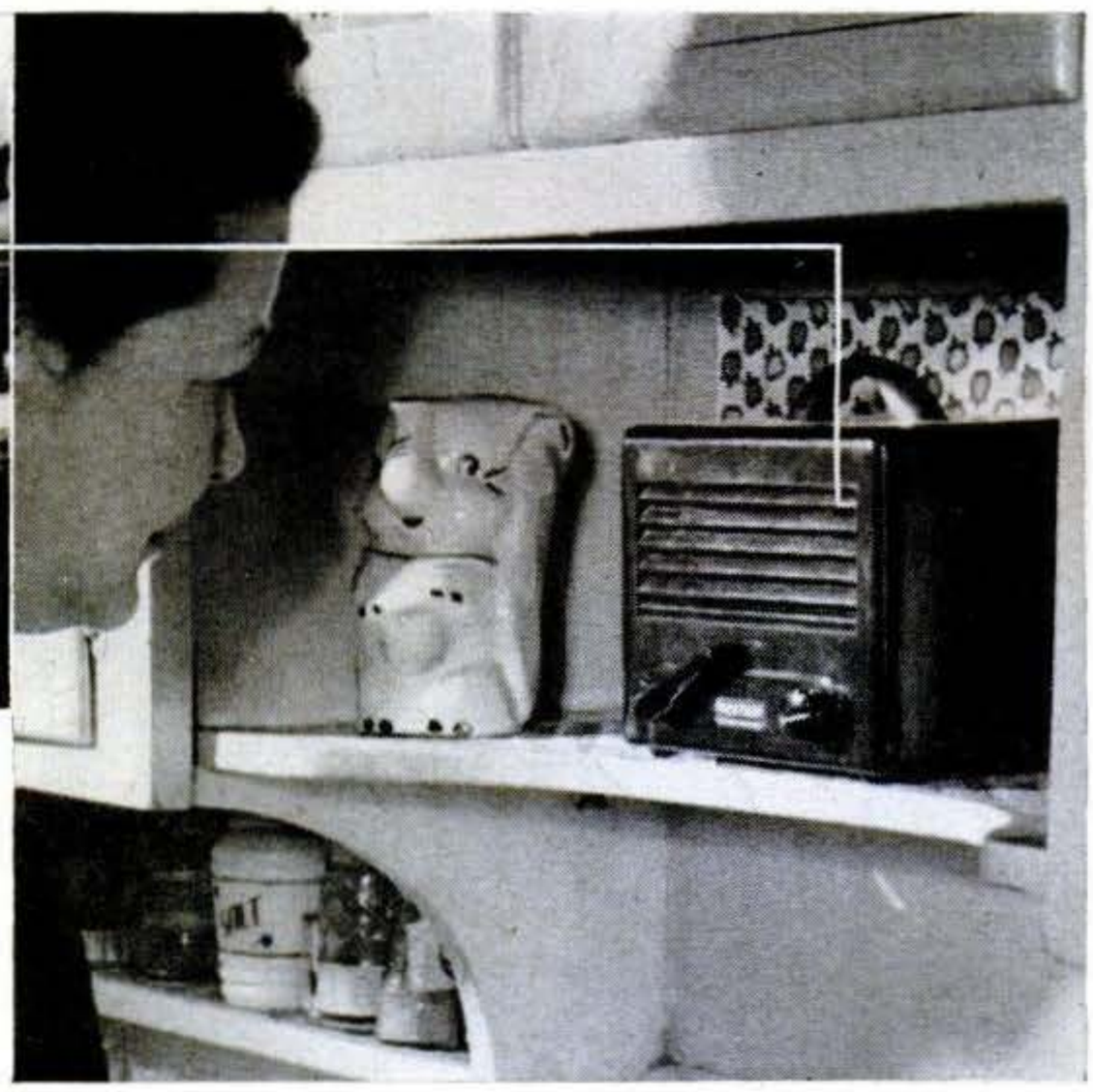
THIS push-pull amplifier adds better sound to a TV set. It plugs into most sets in place of a regular tube and can be used with the existing speaker or an auxiliary one. *Vidaire Television Co., Lynbrook, N. Y.*

Heat Strips Wire Insulation



YOU don't have to take the insulation off this wire before you solder it—you just start right in and the heat of the iron melts the thin plastic coating, baring the wire for a good electrical joint. This not only saves time, but eliminates nicked strands and insulation creep-back. The plastic will not melt under normal circuit temperatures. The Nonstrip Wire is made in a range of sizes and coding colors. *Rex Corp., 51 Landsdowne St., Cambridge, Mass.*

Portable Intercoms Plug in House Wiring, Work Anywhere



YOU just plug these intercoms into home or office electrical outlets and messages are carried over the regular power lines. A suppression circuit quiets line noise when the units are on stand-by. *Vocaline Co., Old Saybrook, Conn.*

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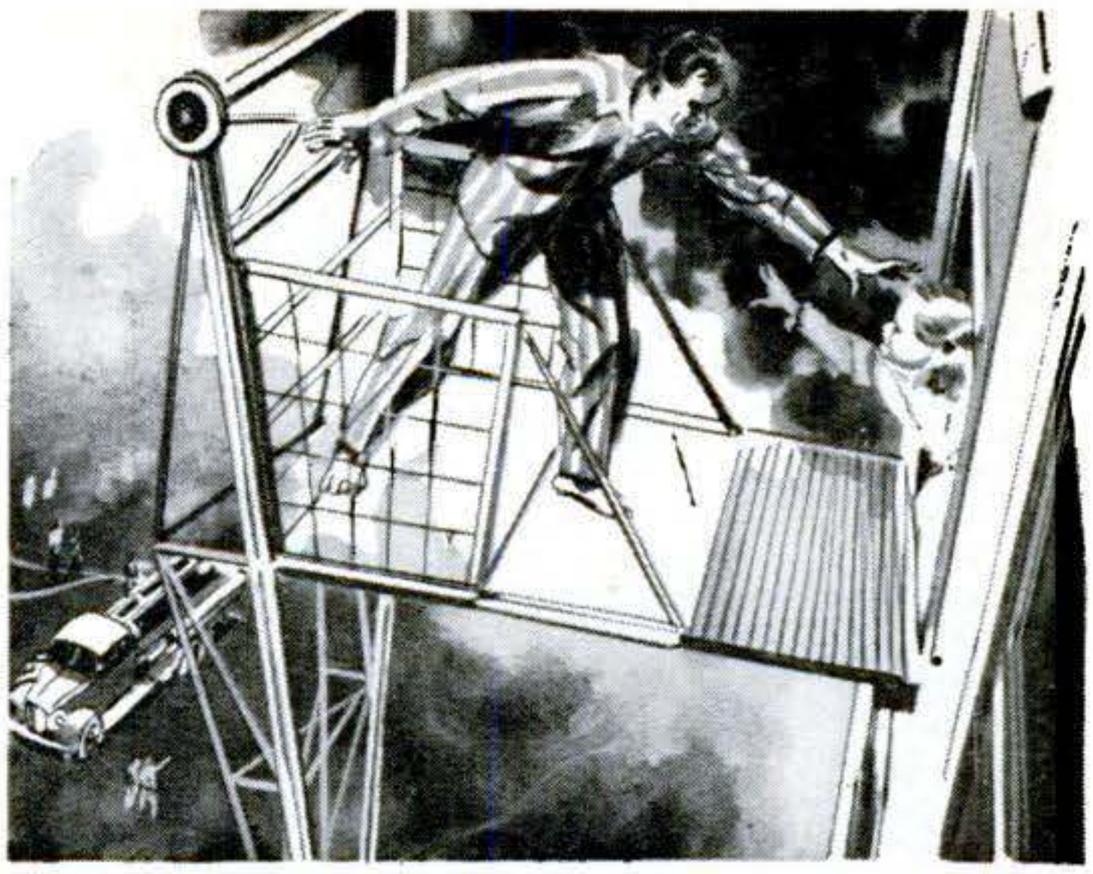
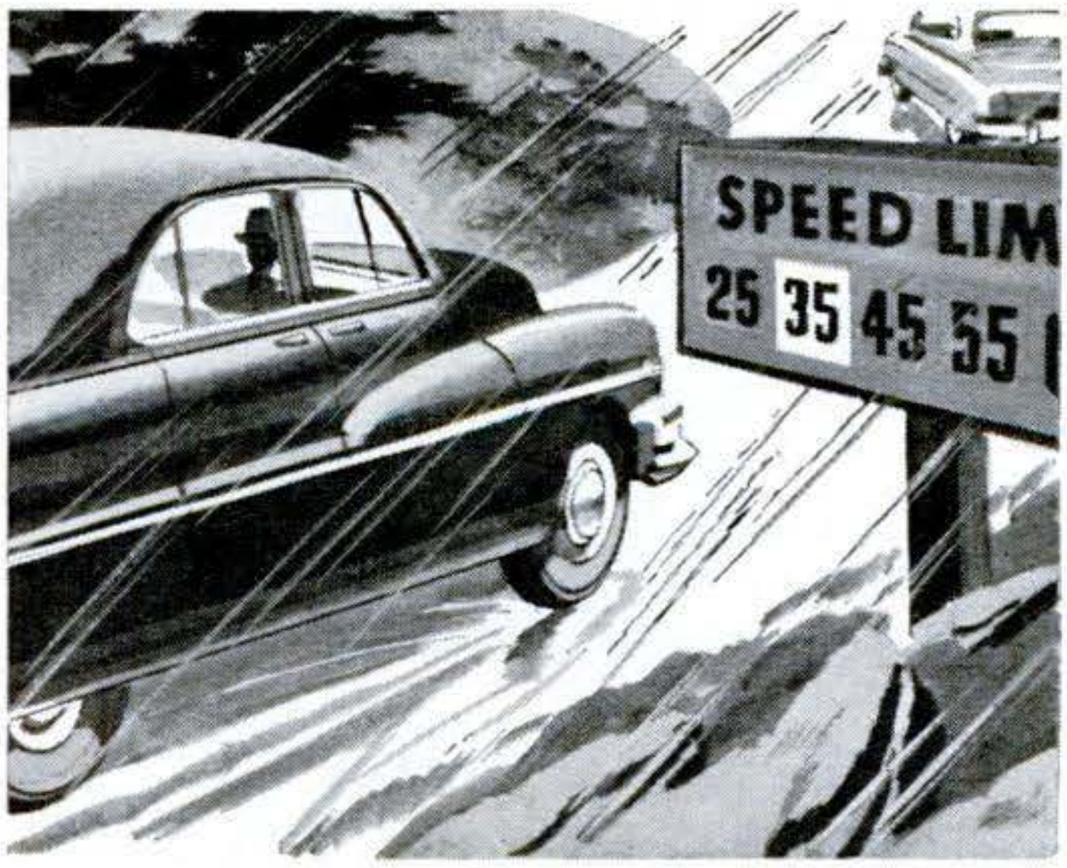
I'd like to see them make...

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science Monthly* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



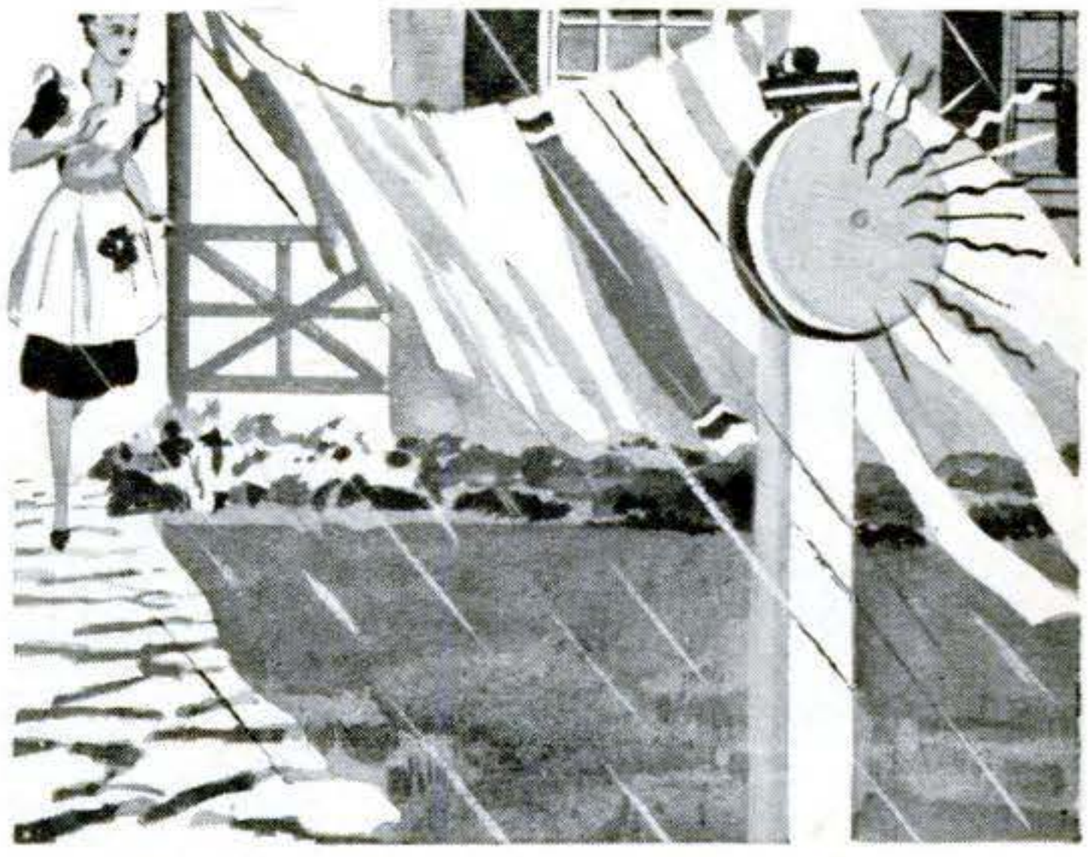
A FIRE LADDER WITH AN ELEVATOR CAGE on it, for quick rescue of several persons who were trapped inside a burning building.—*A. G. Shade, Springfield, Mo.*



CHANGEABLE, LIGHTED SPEED-LIMIT SIGNS for parkways. Centrally controlled, they would indicate speed best suited to varying weather and traffic conditions.—*J. G. Sheskin, NYC.*

A TIMER FOR A TELEPHONE, which you could set when making a long-distance call, to let you know just how many minutes you had talked. —*Doyle Carnahan, Indianapolis.*

LUMINOUS-PAINTED MEDICINE BOTTLES for poisonous drugs, to prevent nighttime accidents caused by sleepily reaching for the wrong bottle.—*Allan Kalb, Newark, N. J.*



A MOISTURE-SENSITIVE ALARM, to hang on a clothesline pole, that would ring a bell and warn a housewife when it started to rain. —*Romeo Soucy, Manchester, N. H.*

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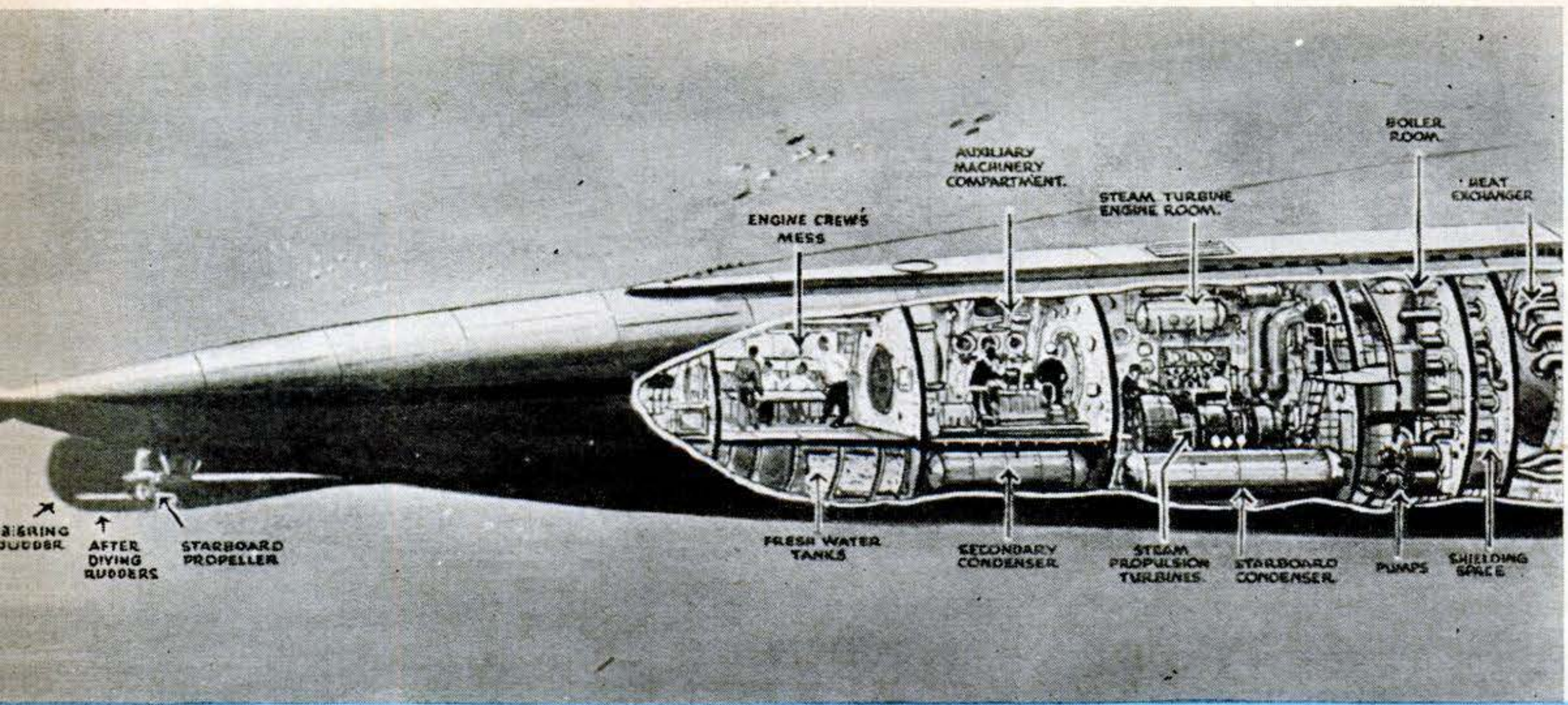


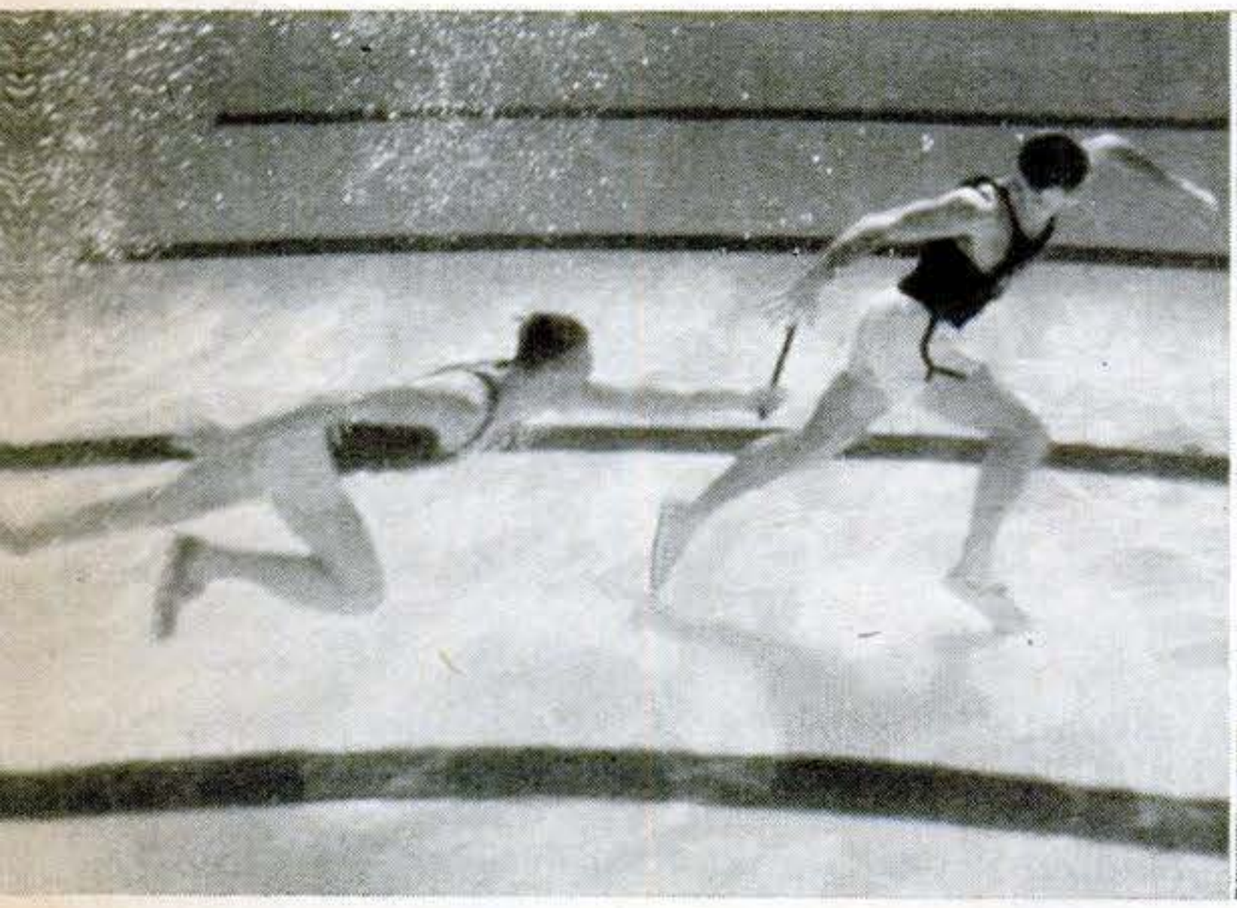
How Atomic Engine May Run Submarine

WHAT an atomic-engined submarine may look like is envisioned above by an English artist, G. H. Davis, in a drawing for the *Illustrated London News*. His sketch was inspired by British Admiralty plans to study nuclear propulsion, and by the U.S. Navy's more advanced progress toward its use.

While the ship pictured here is purely imaginary—actual designs are highly secret—it is held to be in keeping with known

College Swimmers Run Relay Race Under Water

WOULD athletes use the same motions, in running and other sports, if water instead of air surrounded them? Ideas differed until three MIT students, all crack swimmers, tried the novel experiment in the college pool. Through a side window below the surface, a cameraman took these photos of an underwater relay race. Many movements proved graceful, slow-motion counterparts of familiar ones, but there were unforeseen exceptions; a runner "naturally" led with arm and foot on the same side, instead of on opposite sides as in air. The athletes averaged 20 seconds under water and, by expelling all air from lungs, could stay on the pool floor without weights.



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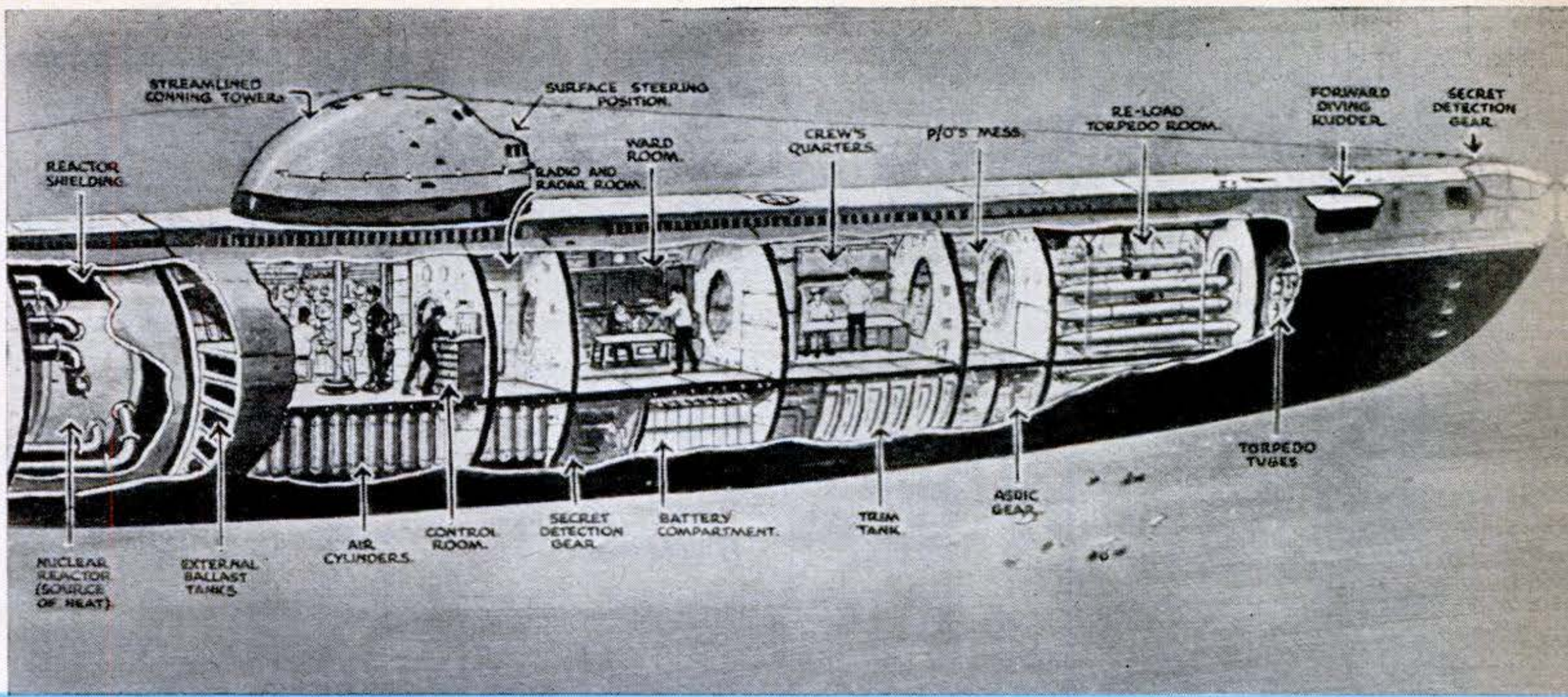

general principles of atomic engines. Heat from a chain-reacting pile, whose shielding protects the crew from radioactivity, makes steam to run a turbine and turn the vessel's propellers. The drive may be through reduction gears or through an electric generator and propulsion motors.

Atom-powered subs will cruise vast distances without refueling and, because their engines consume no precious oxygen, run submerged for prolonged periods. The world's first, the USS *Nautilus*, for whose hull the Navy has already awarded a contract, will be propelled by a Westinghouse atomic reactor of which a "land-based prototype" is currently under development. General Electric will soon build a more radical liquid-metal-cooled reactor that, after trial and necessary modification, will be directly installed in another U.S. sub.

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MECHANICS OF LIVING

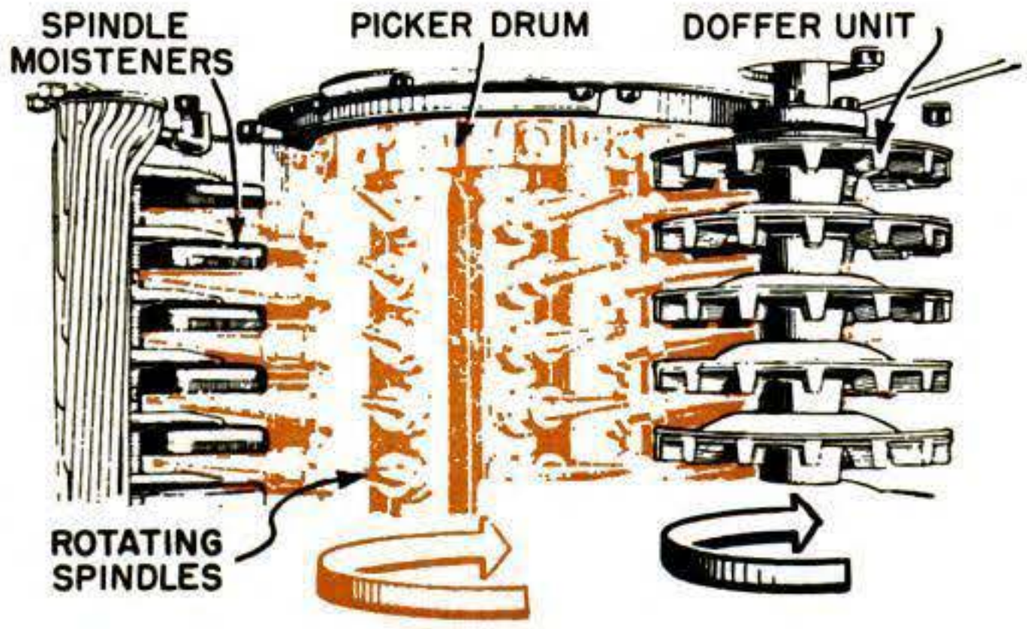
How a Cotton Picker Works

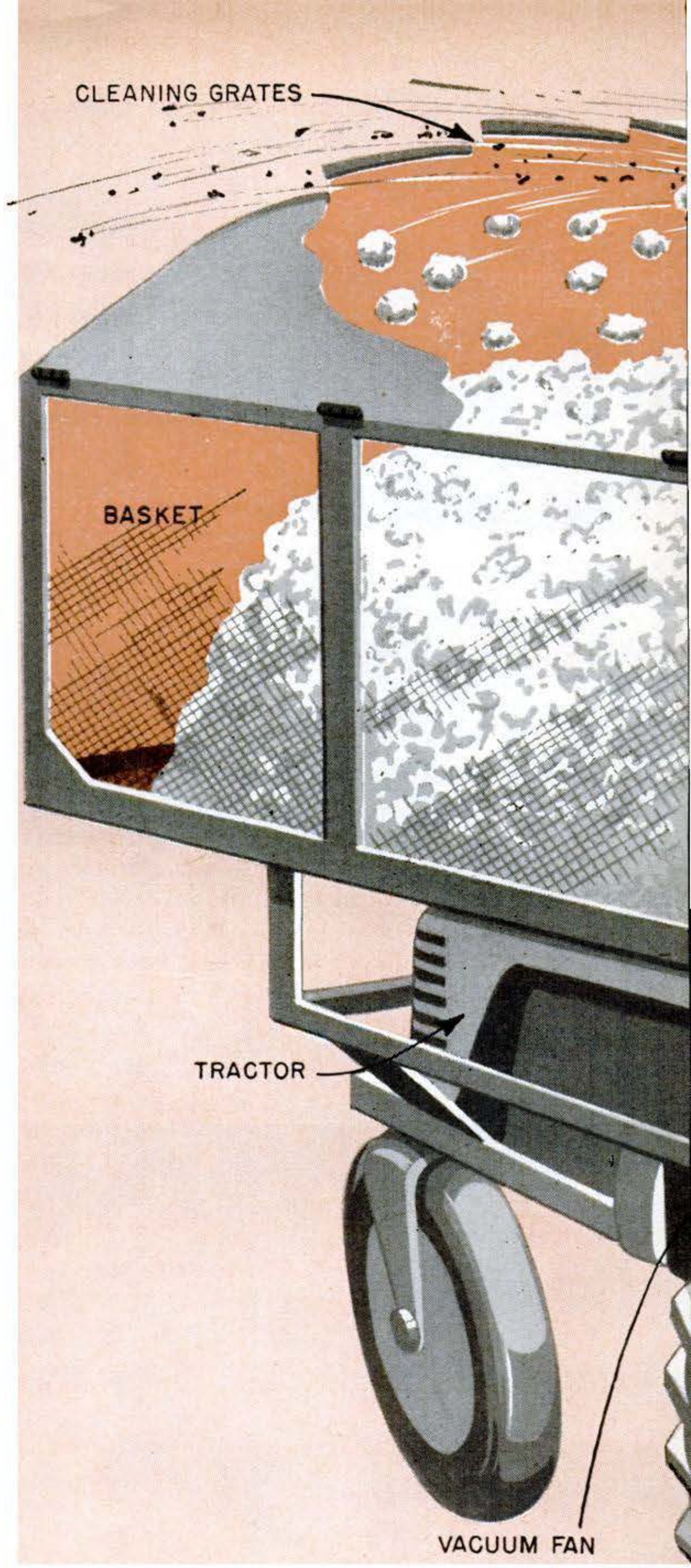
JULY is the month when the South's annual cotton harvest begins. It is a long harvest because cotton bolls don't all ripen at once. Each of the great, flat fields must be picked over two or three times before the season ends. But as soon as enough snowy blooms are visible to give the signal, men start methodically driving big mechanical cotton pickers up and down the long rows of plants. Each picker plucks two tons of ripe bolls a day, or 60 times as much as the average man could pick.

Inventors were trying to build practical mechanical cotton pickers as long ago as 10 years before the Civil War. The goal was not achieved until 1935, and mechanical pickers have been in general use only since the end of World War II.

There are three principal makes on the market now, all operating somewhat similarly. The picker shown on these pages is made by International Harvester. It is mounted on a tractor modified to drive backwards.

BOLLS ARE PLUCKED off plant by two moistener-spindle-doffer units mounted on front of cotton picker. Drawing below shows a side view of one, with the front end at the reader's left.





AS THE PICKER MOVES along a row (see diagram at upper right on facing page), its spring-loaded lifters guide the plants into two revolving drums studded with rotating, barbed spindles, 300 to a drum. The spindles, moistened at each revolution, are so spaced that they pluck the puffy ripe bolls but let the unopened green ones pass. Revolving rows of rubber doffers then snatch the blooms and drop them to two pipes which function like vacuum cleaners. A vacuum fan sucks in the blooms, blowing them up to the picker basket.

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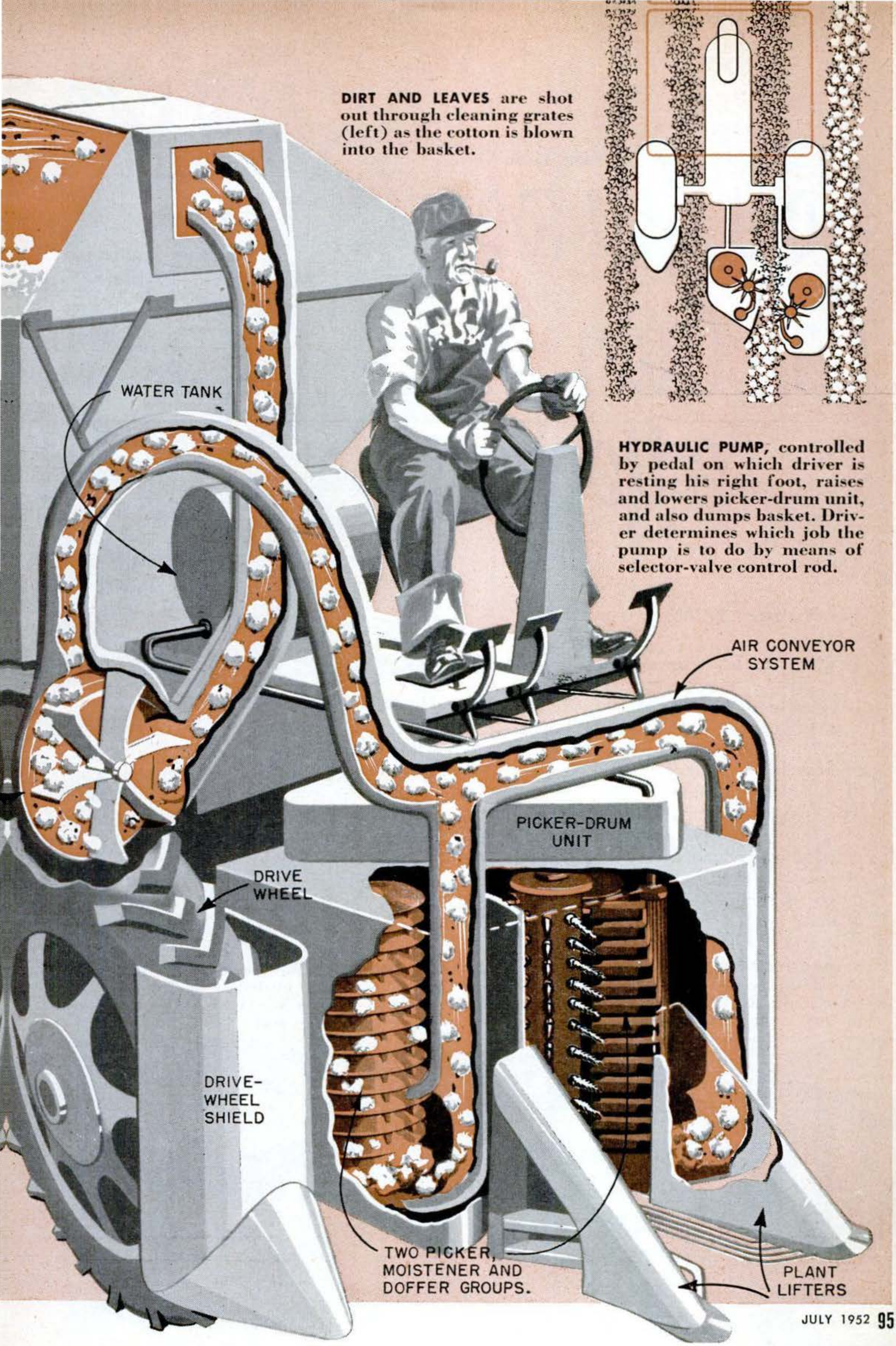

DIRT AND LEAVES are shot out through cleaning grates (left) as the cotton is blown into the basket.

HYDRAULIC PUMP, controlled by pedal on which driver is resting his right foot, raises and lowers picker-drum unit, and also dumps basket. Driver determines which job the pump is to do by means of selector-valve control rod.

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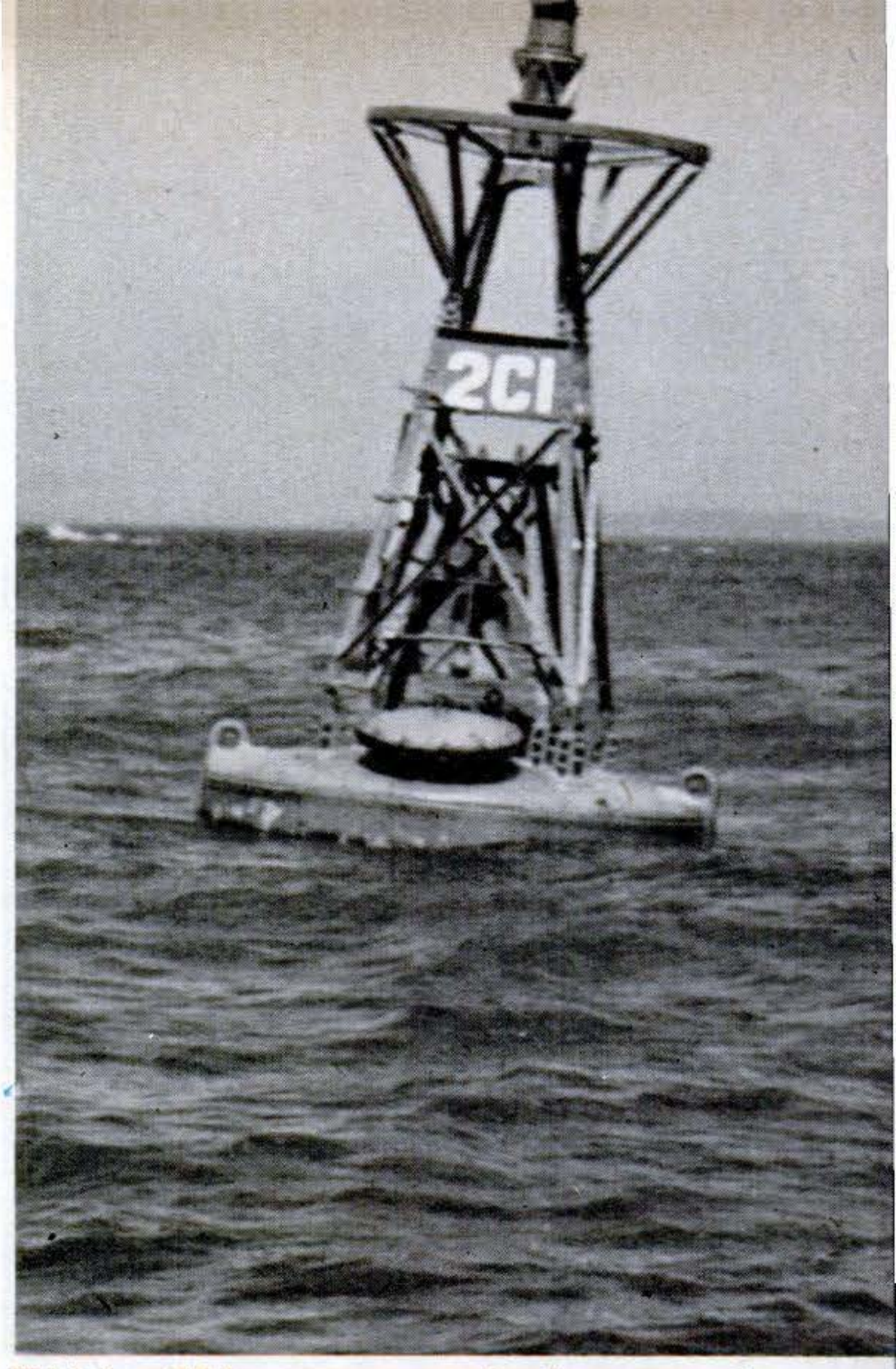
Now You Too Can Own a Yacht



With her 25-horsepower engine hung over the

By Robert J. Whittier

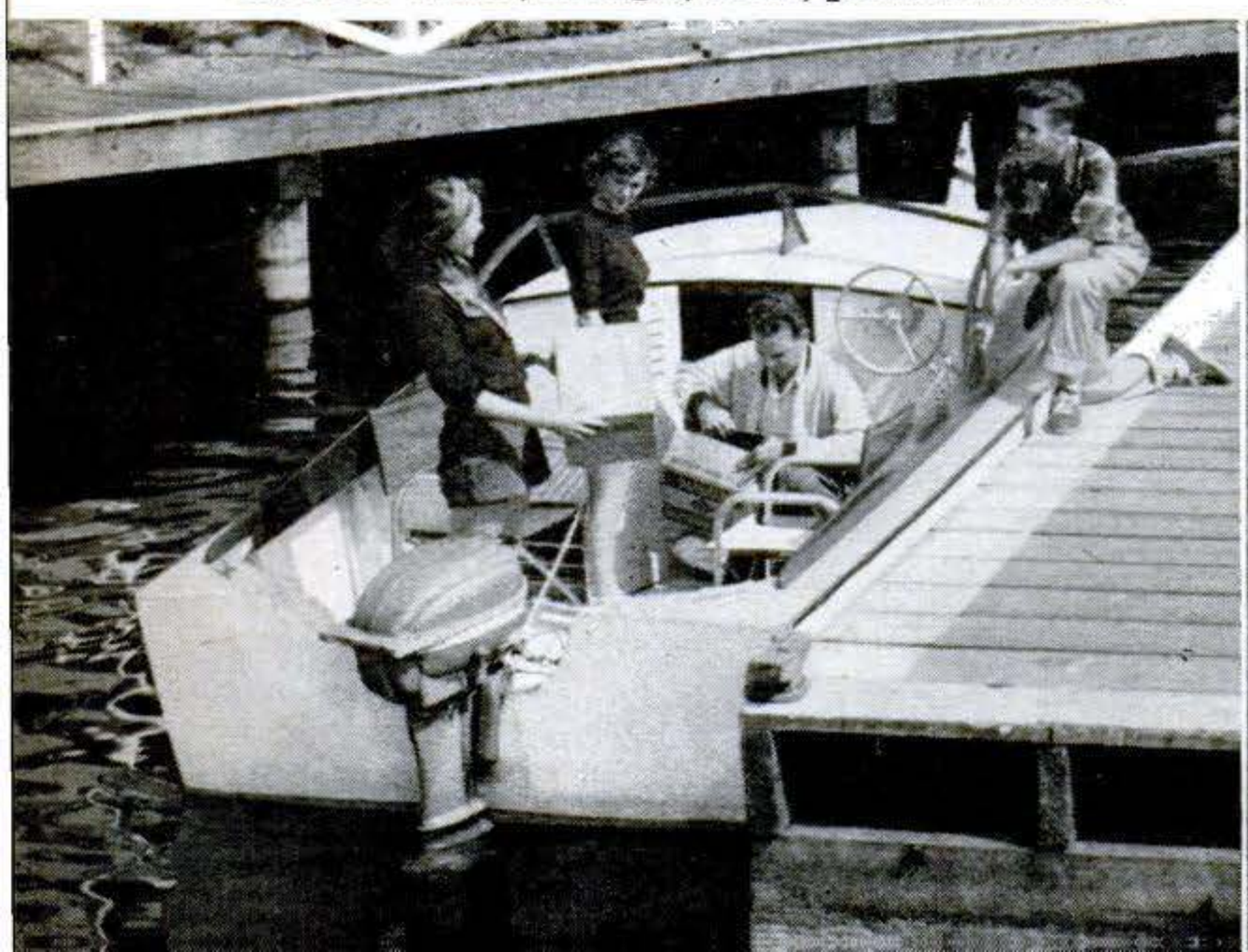
ONE of these summer days you may glance down the river or out over the bay and notice a jaunty little cabin cruiser coming your way at a swift clip.

"Man!" you muse as she draws close enough for her details to become clearer, "I sure wish I could afford a rig like that!" The trim craft whizzes past and you look after her enviously. Instead of a steaming cloud of engine exhaust swirling behind her, you're astonished to see an outboard motor on the transom. Maybe you can afford her, at that!

For the outboard cruiser—a cabin cruiser powered by an outboard motor—is currently invading the boating world with as much promise as Henry Ford's Model T invaded motordom 40 years ago. Outboard enthusiasts predict that it will bring cruising within the reach of the average American just as the "Tin Lizzie" brought him motoring.

If you're in moderately comfortable cir-

A LARGE COCKPIT for day trips is feature of this 25-hp. cruiser. Cruising outboards run from about 10 to 33 horsepower, depending on boat's size, design, load, performance.



THIS 19-FOOTER was built from blueprints. Note how 9.8-hp. outboard sits in stern well. Outboard cruisers are 16 to 20 feet long, cost from hundreds to over a thousand dollars.

stern, this cabin cruiser packs a maximum amount of living space into her 17 feet of length.

cumstances you can buy a ready-made outboard cruiser today. If you're short on cash but handy with tools, you may still be able to launch your own home-built craft next season.

Outboard cruisers aren't new—but they've been pretty rare. Now two factors have suddenly brought them into the limelight. The ever-increasing cost of inboard-engine craft is forcing many yachtsmen to look around for more economical ways of enjoying life afloat. And during the last few seasons several outboard-motor manufacturers have introduced larger, more versatile models that are nevertheless reasonably priced.

Boats Come Complete or in Kits

Several firms now make these boats. Some companies also offer construction kits with all parts cut out and ready to assemble with common hand tools. Or you can get a catalog of boat plans from the Douglas Fir Plywood Association, Tacoma, Wash., for a dime.

What is the appeal of this newcomer? In a nutshell, it's this: The outboard cruiser combines the inboard's cruising abilities (except for offshore work) with the outboard's portability, ease of handling afloat and ashore, and relative economy.

Although the average length of a cruiser is only 18 feet or so, there is a surprising amount of room aboard. No space has to be taken out of cabin or cockpit for a bulky inboard-engine compartment. It is as though the engine were removed from an automobile and clamped to the rear bumper —leaving that much more usable space within the car's body.

The typical outboard-cruiser cabin has ample sitting headroom and is fitted out with two bunks, a small stove, a portable icebox and storage space for enough supplies and equipment for several days afloat. Often a toilet is installed. The cockpit is clear, well adapted to sport fishing, and roomy enough for several occupants. Two people can comfortably spend several days afloat and a whole party can make daytime excursions without being crowded.

A "bare" outboard cruiser—with the engine removed—is small and light enough to

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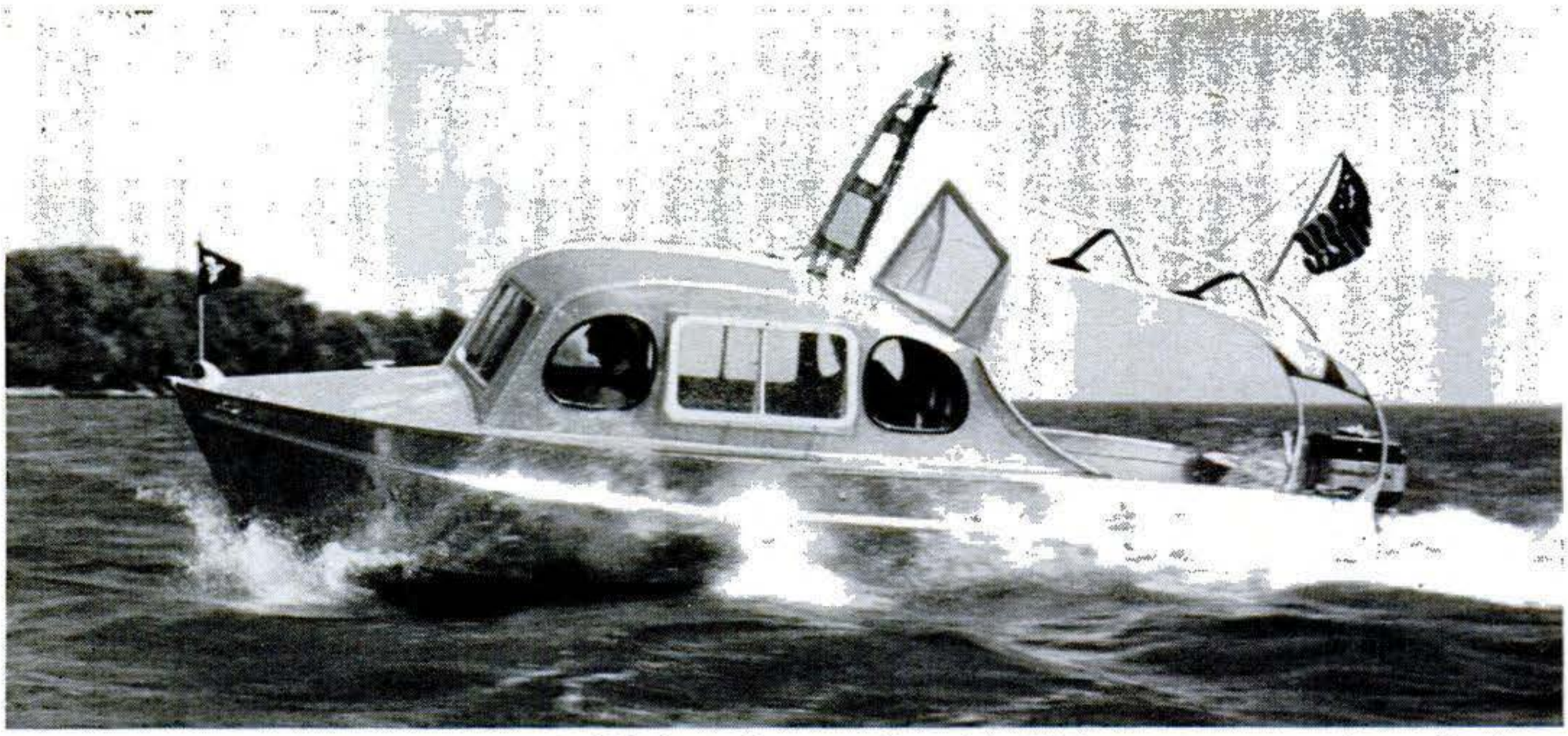

ALL-ALUMINUM EXPRESS CRUISER is 18 feet 4 inches long, has 6-foot beam, knocks out 25 m.p.h. with 25-horsepower engine. Cruiser-size outboard motors cost $250 to $500 new.

be readily hauled out of water on a two-wheel boat trailer. Thus the owner avoids marine railway and boat-yard charges by taking his craft to a barn or large garage for winter storage. Most important, he is not confined to one body of water.

It is common for an outboard-cruiser owner to spend one week end on a salt-water bay and the next on a large lake far inland. A particularly attractive feature of these boats is that on long cross-country tows, they can be parked by the roadside and used as snug overnight shelters. At sunrise you promptly launch the craft and set out on a long day of fishing. Even if it rains, you can still fish in comfort. It's the nearest thing yet to the convenience of the turtle's shell.

Because outboard motors tilt if they strike underwater obstructions, it is safe to venture into interesting backwaters where no inboard skipper would dare go. Rivers with their sand bars, swamps with their weed beds and snags, and salt-water creeks whose depth varies with the tide don't scare the outboard cruiser. Should weeds foul the propeller, the motor is merely tilted so you can reach down and pull them off. There is no need to tow a dinghy for landing, either, since you can run these boats right up onto a beach without damage.

In cost, the outboards also have it all over the inboards. They have no need for exhaust plumbing, engine girders, electrical systems, stuffing boxes and so on. The motors themselves cost less than inboard engines, and because they are readily removed from the boat, servicing and repairs are easier and more economical. At the same time a lighter engine means a lighter hull—and that saves money, too.

KITS, TOO. This 19-foot model, made by a famous builder of inboard motorboats, can be bought ready-made or in kit form. Most kits cost 30 to 50 percent less than finished cruisers.

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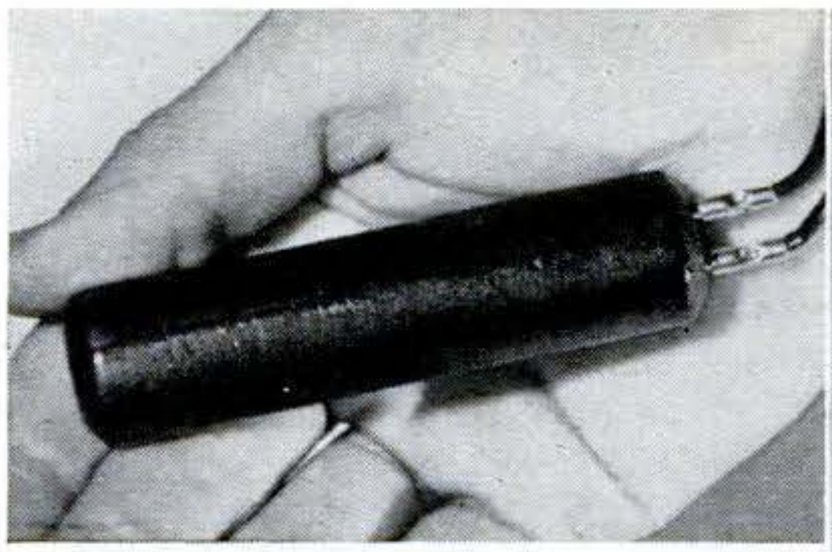
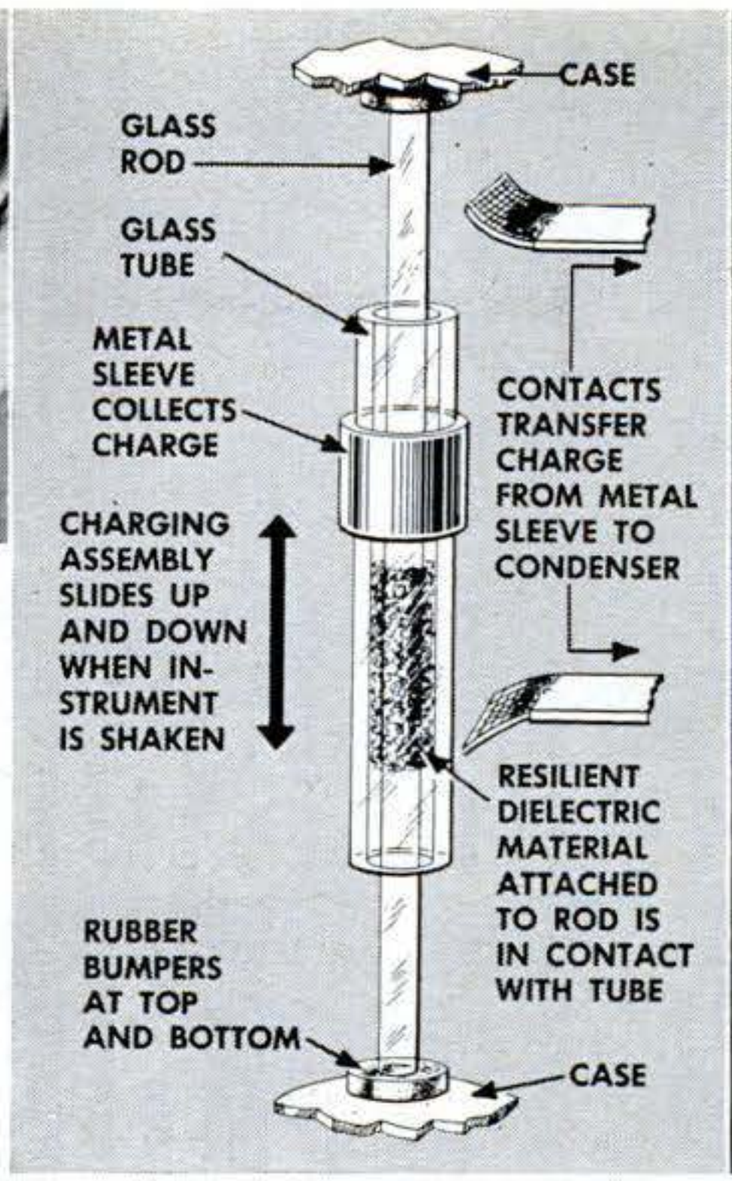
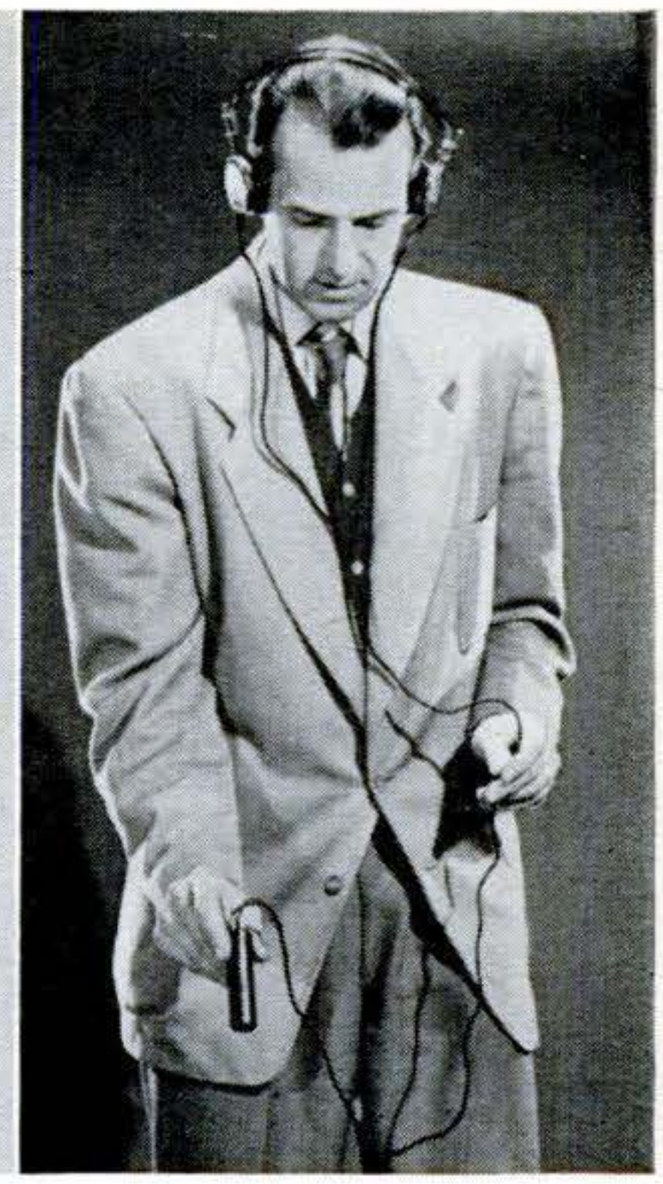






Baby Uranium Finder Needs No Batteries

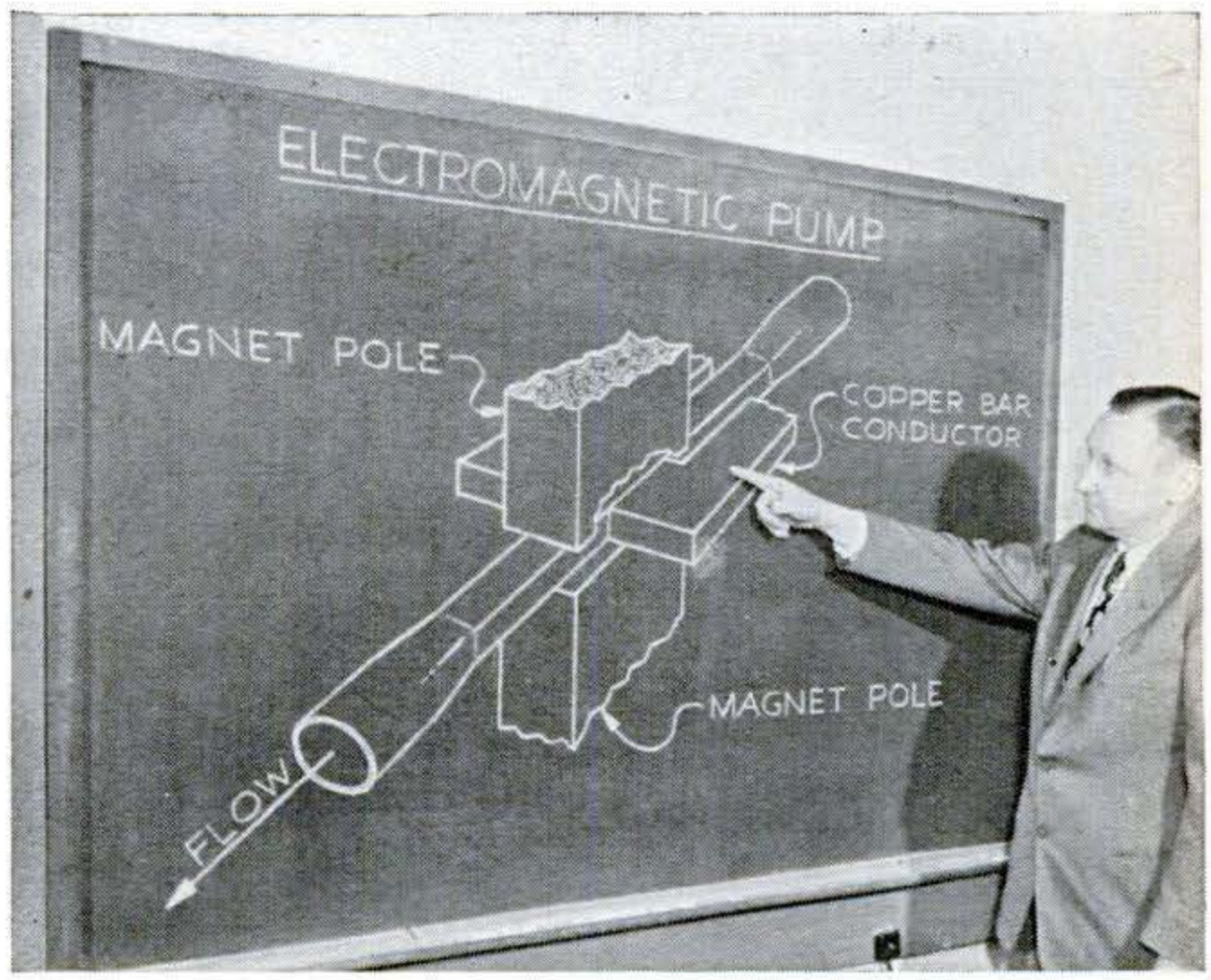
ONLY an inch in diameter and four inches long, a tiny Geiger counter for uranium prospectors dispenses with batteries. Before use (far right), you merely shake it up and down 20 to 30 times. This charges an energy-storing condenser by operating a simple frictional generator of static electricity (diagram). Including headphones to listen for telltale ore-detecting clicks, the outfit weighs less than half a pound. Called the Geiger-Mite, the counter is sold at about $30 by Morgan Instruments Co., Canoga Park, Calif.

2-Engine Plane at Bargain Price

THE Twin-Stinson, which can cruise at 150 miles an hour with four passengers, is expected to sell for less than $25,000. Piper Aircraft plans to have the plane, which is powered by 135-horsepower Lycoming engines, in production by 1953.

Magnetic Trick Used to Pump Liquid Metal

DESIGNERS of power-generating atomic piles favor liquid metals—like sodium and potassium, which liquefy at moderate temperatures—for cooling and heat transfer. Electromagnetic pumps, with no moving parts, solve the problem of how to circulate them. In one successful type (right), direct current passes through liquid metal in a pipe, while magnet poles set up a magnetic field. This makes a "motor" whose "armature," the liquid metal itself, is propelled by magnetic forces.



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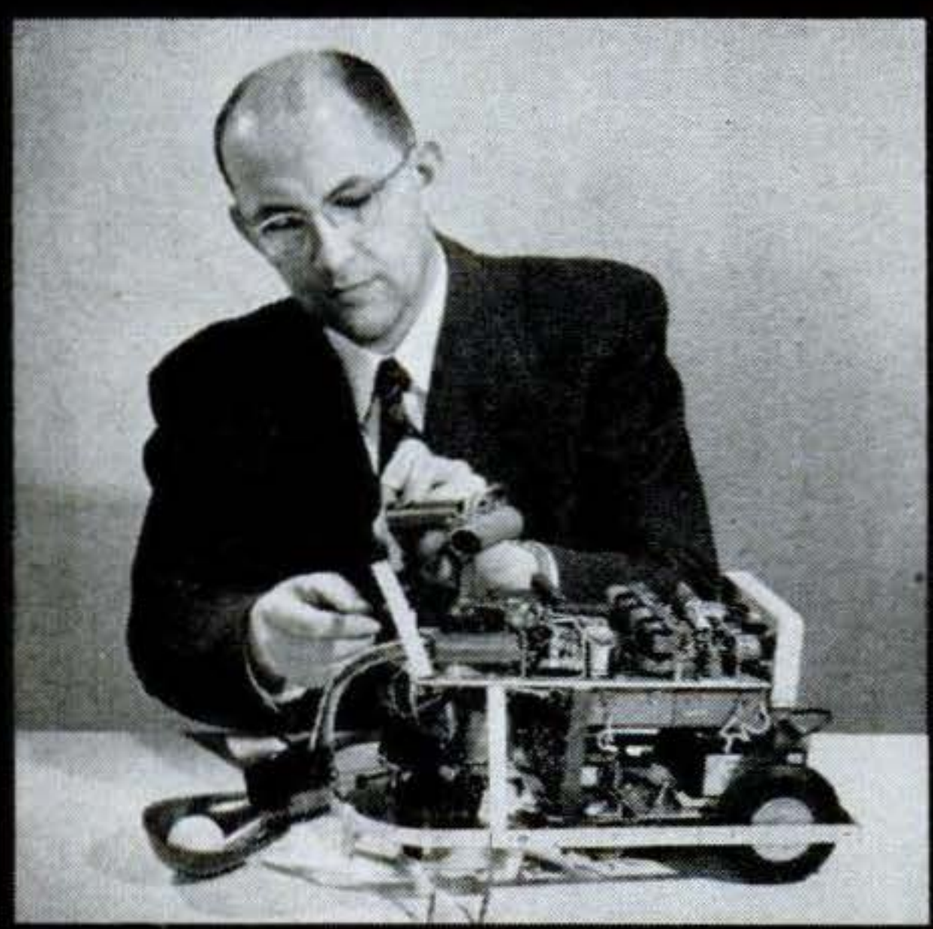
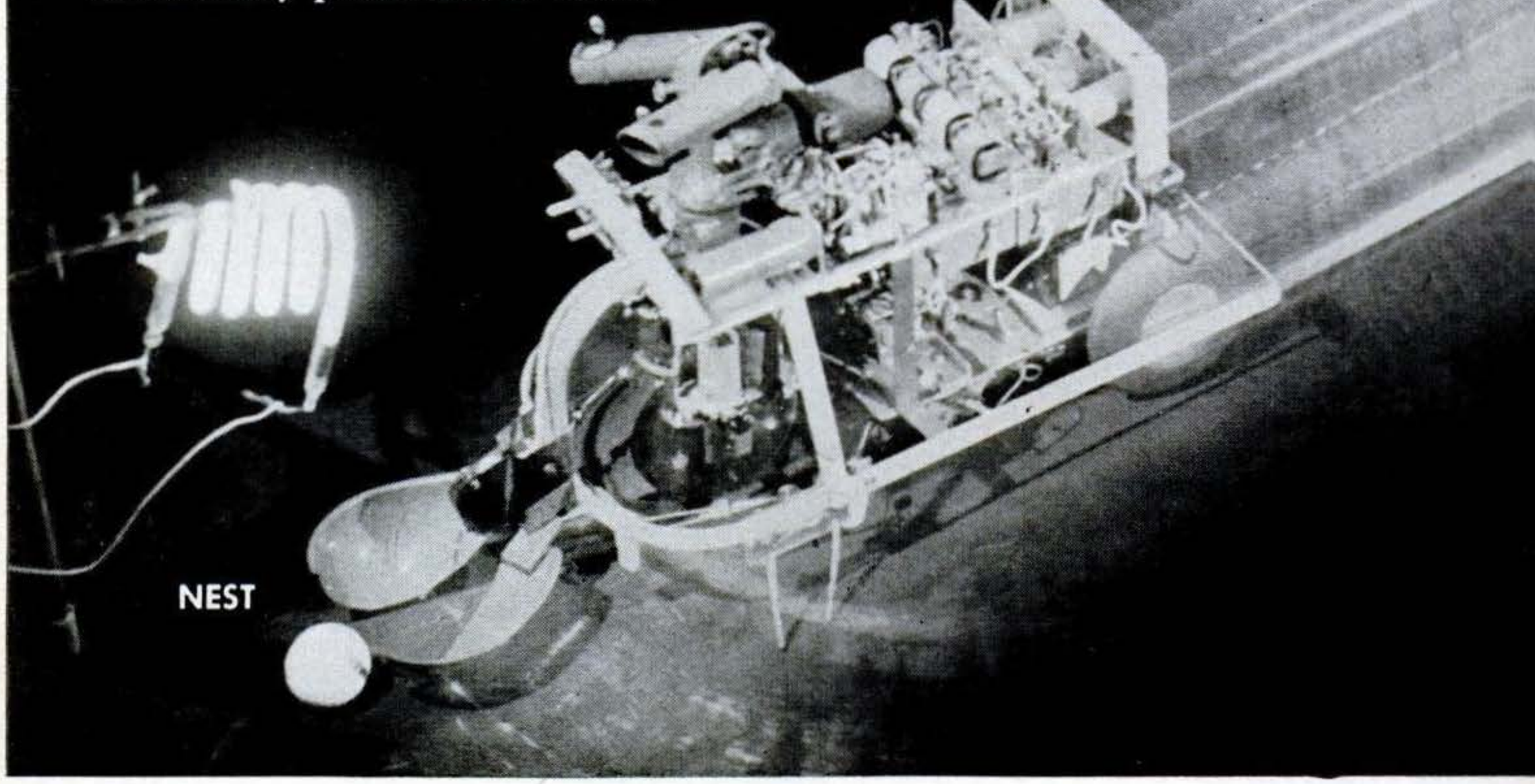
Robot Squirrel Hunts His Own Food

When you shine light in Squee's phototube eyes, this little electronic squirrel goes nuts.

PSM PHOTOS BY HUBERT LUCKETT



EDMUND C. BERKELEY, an expert on electronic computing machinery, created Squee to "stir people's interest in the extraordinary possibilities of robots."



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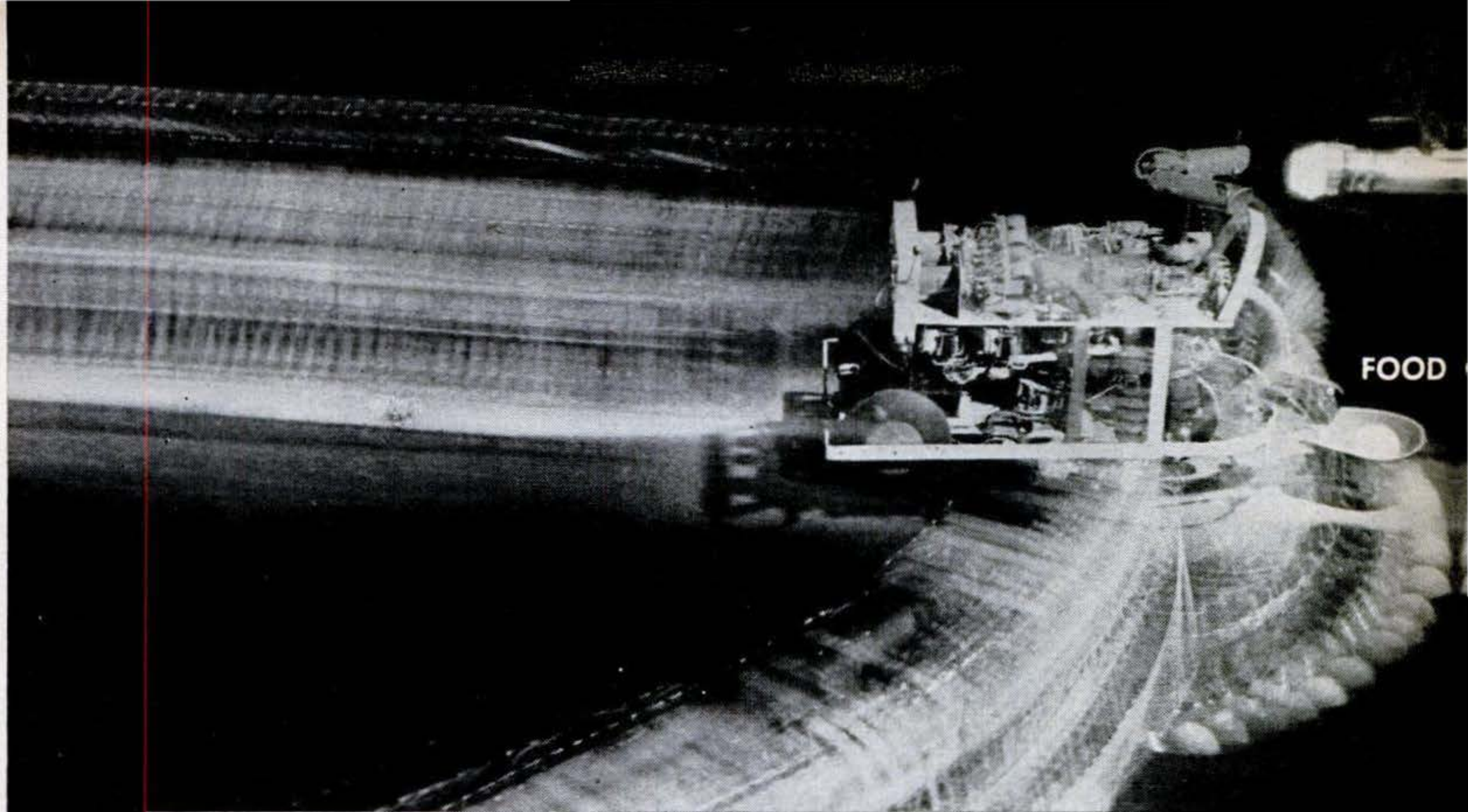

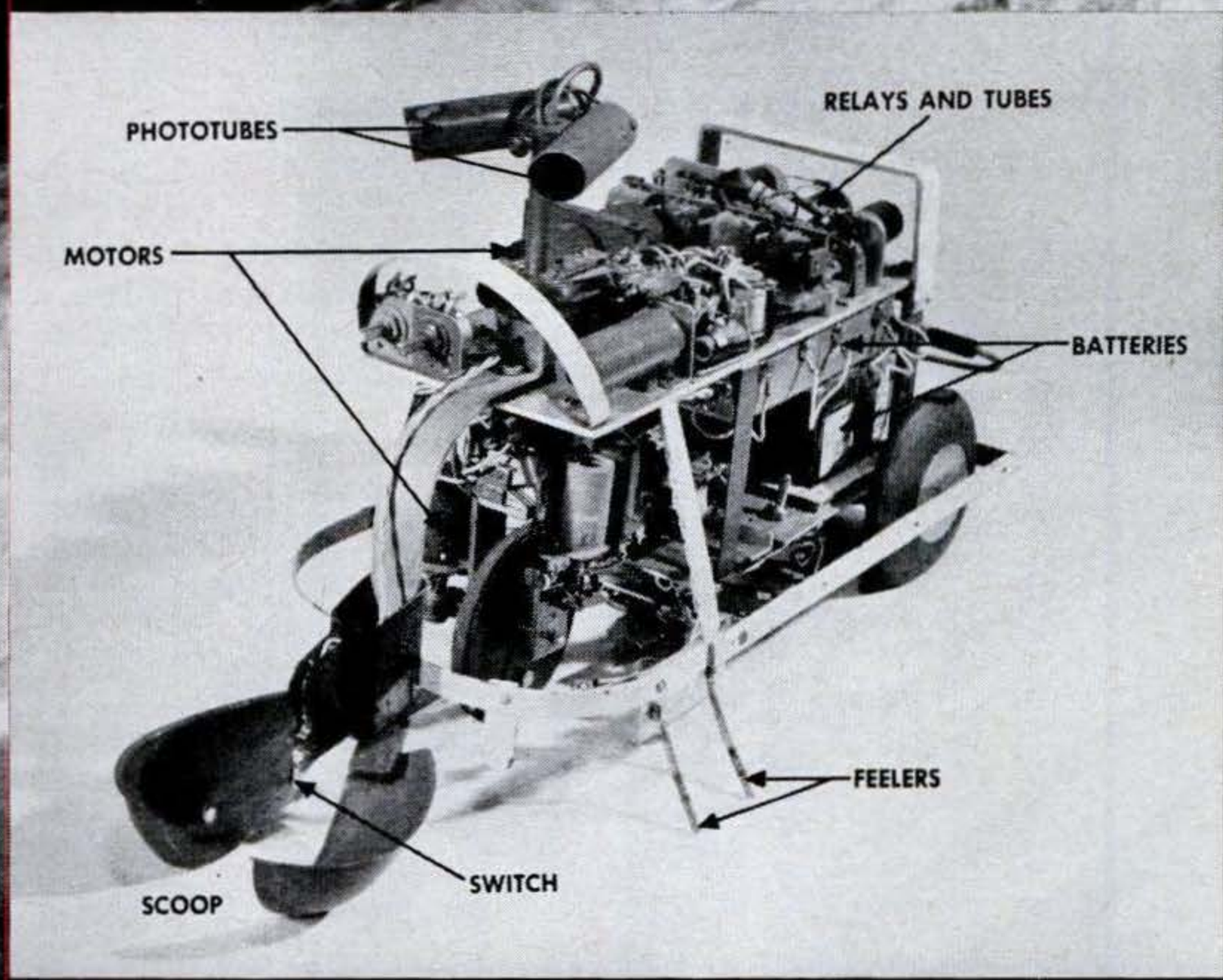

LIKE REAL SQUIRREL, Squee has sensing organs (phototubes, switches, feelers); acting organs (three motors to drive, steer and operate scoop); and thinking organs (12 relays, seven vacuum tubes). Powered by one 12-volt wet battery and two 67½-volt dry batteries, what Squee really eats is electricity.

THIS electronic animal behaves like a real squirrel. It looks for a nut, runs to it, picks it up, carries it to a nest, then hunts for another nut. The nuts that it collects, however, are usually golf balls, and the nest to which it takes them is an aluminum plate. The sensitivity of Squee's phototube eyes accounts for his action. They respond differently to a steady light than to a flickering light. Whoever runs the squirrel must place a steady light (in this case a flashlight) behind the nut. When the nut enters the scoop, the squirrel's circuits are switched to make him search for a flickering light placed over the nest. A gas-filled lamp that flashes on and off 120 times a second then lures Squee to his nest, where he deposits the nut—and starts all over again.

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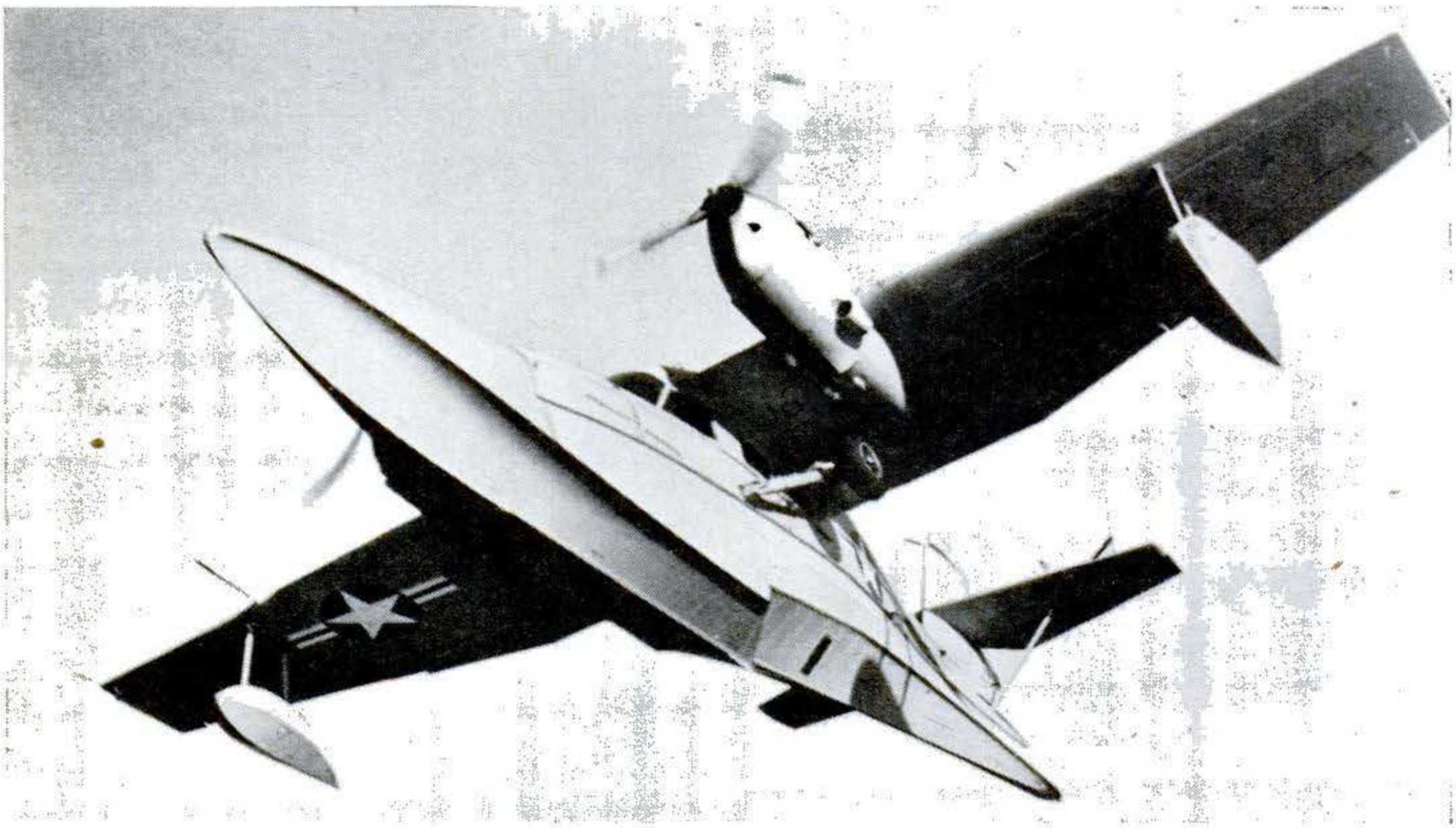
PONTOONS have one-piece decks and bottoms. Overhanging deck stops spray, and runners underneath make beaching easy.

TANDEM water bikes and lightweight models for children are made in addition to standard type.

Pedaling Up the River on a Sunny Sunday Afternoon

THE seagoing bike above is said to be unsinkable and swamp-proof. The steering post is linked directly to a front rudder and there is direct drive from the pedals to an eight-bladed paddlewheel that puts water behind you fast. The maker, Selleck Watercycle Co., New London, Conn., reports it can go as fast as a rowboat with less work.



Slim Hull Hitches Plane Ride

THIS narrow, knifelike hull for flying boats—slimmest ever built—was designed for big amphibians of the future. It is shown above being flight-tested on a Grumman Widgeon specially modified—the bow and underbody were chopped off—so that different hull types can be easily bolted in place. Designed by the Navy and Convair and built by Edo, the hull has a window just behind the main step from which movies are made of the water flow.

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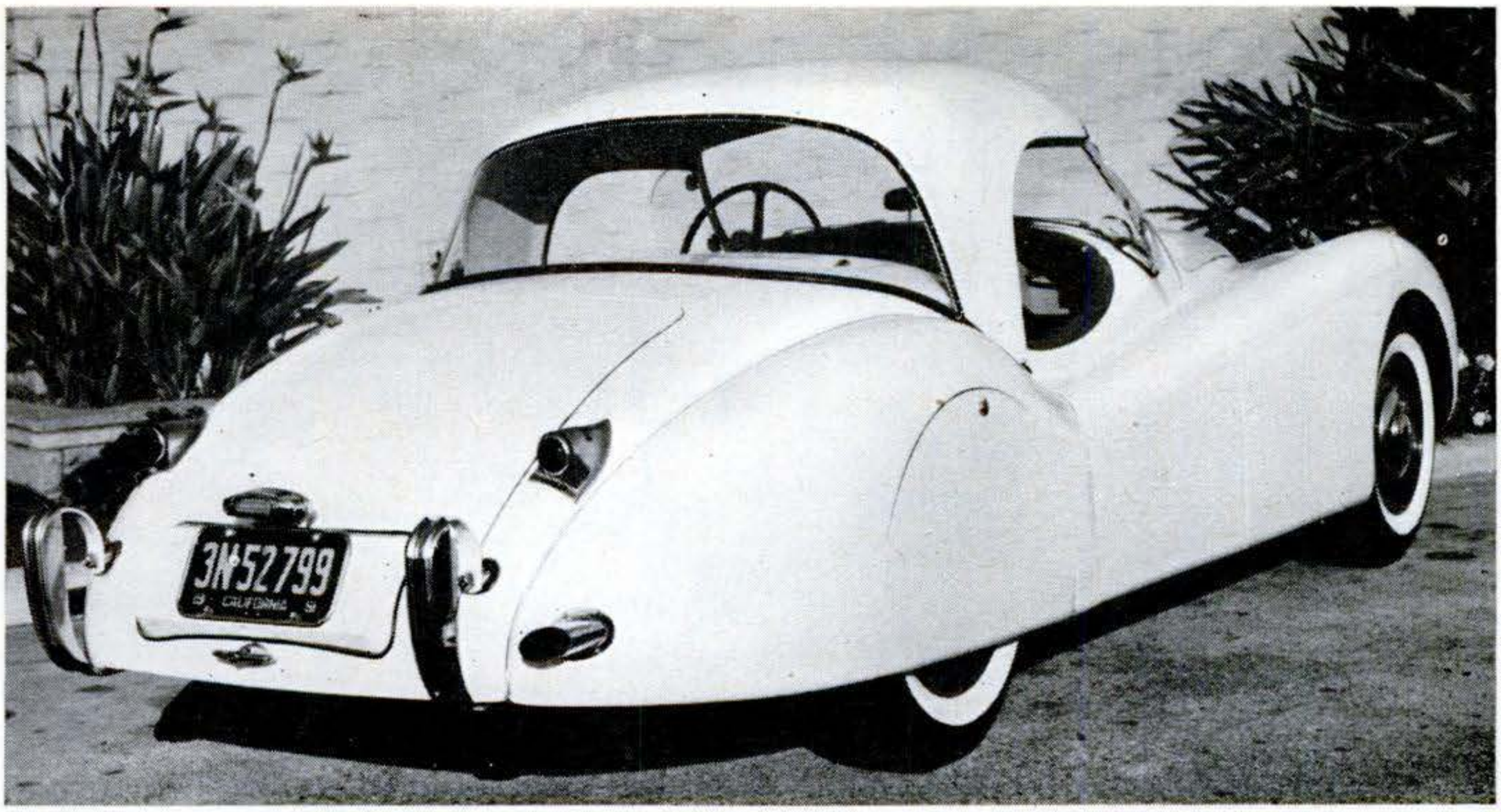

Hard Top Converts Convertible

JAG owners can further convert canvas-topped convertibles with this lightweight hard top made of Fiberglas. Only two holes need to be drilled to install it, one on each side of the car alongside the seat. The rear window is of Plexiglas. The whole business weighs only 21 pounds, is easy to lift into place, and can be put on or removed in a few minutes. A builder of plastic car bodies, the Glasspar Co., Costa Mesa, Calif., makes it. A Jaguar with a regular hard top made as part of the body appeared this winter (PSM, Feb. '52, p. 130).

75 years ago this month

Popular Science Monthly reported:

"A PREPARATION of tungstate of soda and starch has been highly recommended for rendering muslin dresses uninflammable. At a recent trial of it in London, the dress fortunately being placed on a dummy, the saturated fabric readily took fire, blazed up, and was quickly consumed."

Sundial Is Star Dial, Too

DAVID THOMSON invented the celestial timepiece above. Two nested brass rings are marked for the days of the year and for time. To check his watch, Thomson takes a fix on the sun or the North Star, twirls the rings and reads them. Time is Thomson's job—he's a time-study engineer for Buick.

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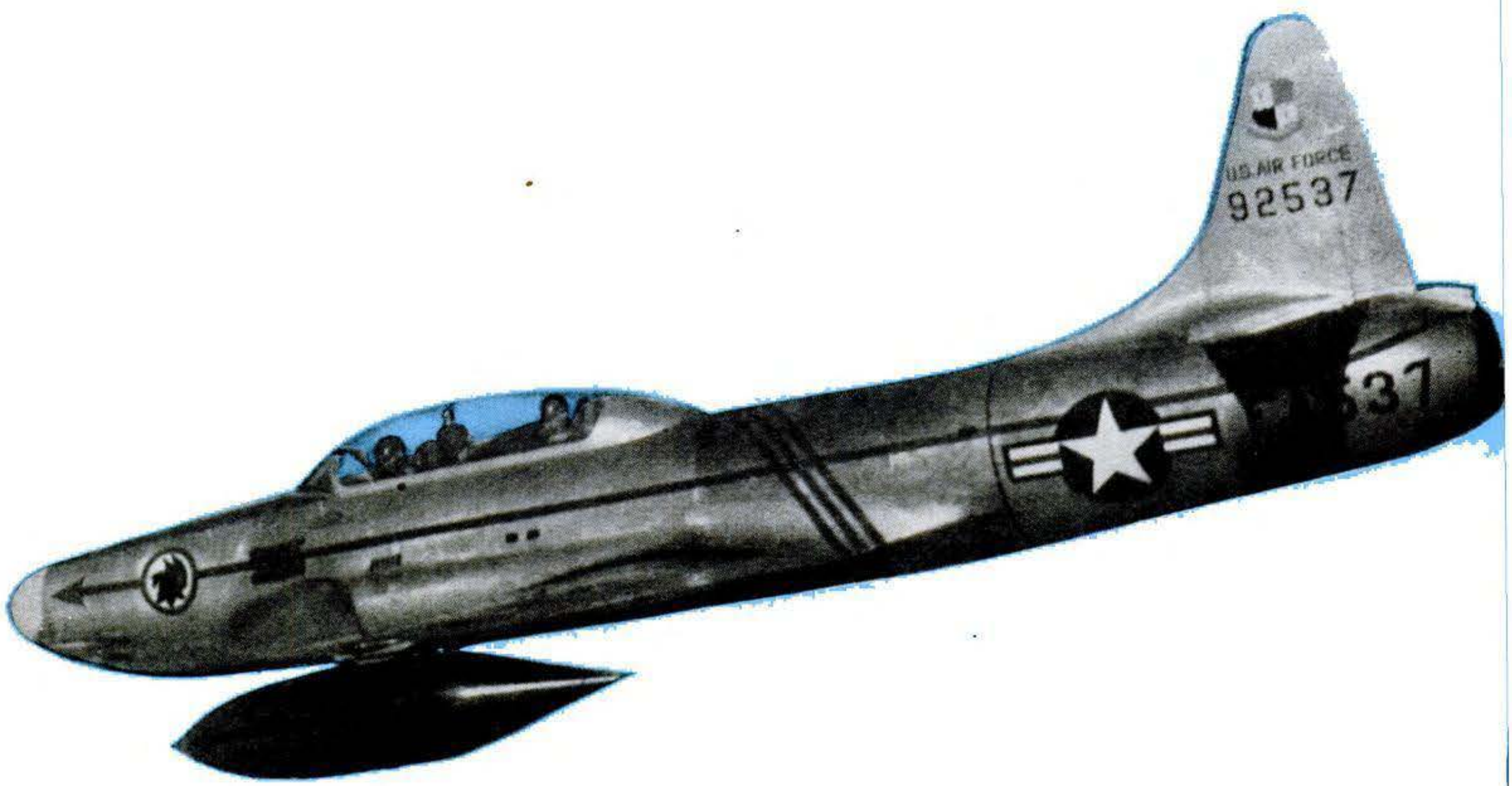

FLOYD FEW, right, confers with his jet pilot at Tyndall Base, Florida, where four weeks' final training follow graduation from Connally. He's now Second Lieutenant Few.

By Phil Gustafson

AVIATION CADET Floyd J. Few was sweating it out on the hot seat.

Lightproof curtains blacked out the after fuselage of a high-flying B-25, where he sat bundled up to the ears in flight gear and parachute. Strapped stiffly erect in a bucking steel-backed seat, he frantically manipulated controls on a radar set.

Somewhere else in the sky was an elusive target plane. He could see it only as a blip, a bobbing little oblong spot of light, on his radar scope. His task was to guide the B-25 to it, strictly on instruments. Up ahead, a pilot's hands were on the controls—but it was Floyd who was actually flying the B-25, by telling the pilot over the intercom to climb, dive or turn.

The target plane simulated an enemy bomber headed for a U. S. city; the propellered B-25 represented one of the Air Defense Command's jet interceptors that

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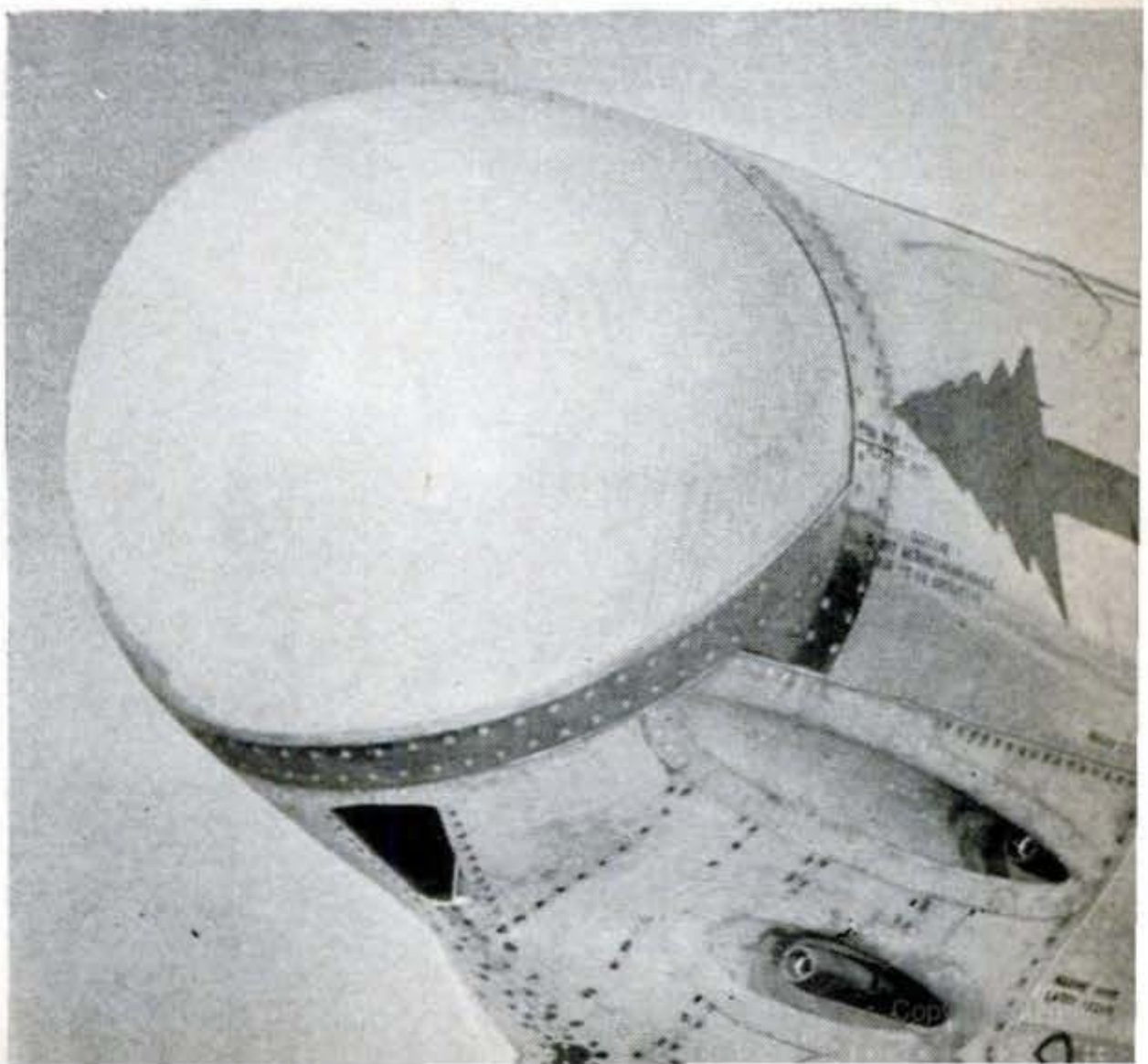
Radar observer, in after seat of jet interceptor, glues his eyes to this scope to track enemy.

would actually be rocketing through the sky in hot pursuit of it. And Floyd was a student learning the role of the radar observer who would be in the jet's after seat. All had seemed to him to be going well as the B-25, trailing by several thousand yards, closed in for the kill.

But suddenly the target plane went into violent evasive maneuvers—prompted by radio directions from a grinning instructor sitting behind Floyd in the B-25. It veered, dived, climbed, circled, weaved. Floyd fought to keep it in the searchlight beam of his radar antenna. It was like trying to follow a wildly intoxicated firefly with a telescope while riding a bucking bronco. The B-25's gyrations pitched him forward, backward and sideward. He could hear an-

HERE'S BUSINESS END of interceptor as it would close in for kill. Guns beneath radar-dome nose are always "hot" (loaded) and ready for action when alert sends crew aloft.



other student aft being good and sick—but no time for him to be!

Watch altitude, speed, range. Keep chattering instructions to the pilot. Did I remember to come out of that bank? Something's gone wrong—the target's drifted off the scope. Then a cold, slow drawl from the pilot:

"If you leave the plane in this dive, Mr. Few, we'll hit the ground in just about 90 seconds."

Undergoing ordeals like Floyd Few's are hundreds of students being trained as radar observers at James Connally Air Force Base near Waco, Tex. After graduation, each man will be teamed with a pilot to man a two-place interceptor for all-weather flying.

They See by Radar

Radar serves as the eyes of these two-man teams. Fog, rain or darkness makes no difference to them. They can take off and trail an enemy craft blind, shoot him down without ever seeing him and come back and land on a runway on instruments. All daytime interceptor units are being converted into these all-weather squadrons.

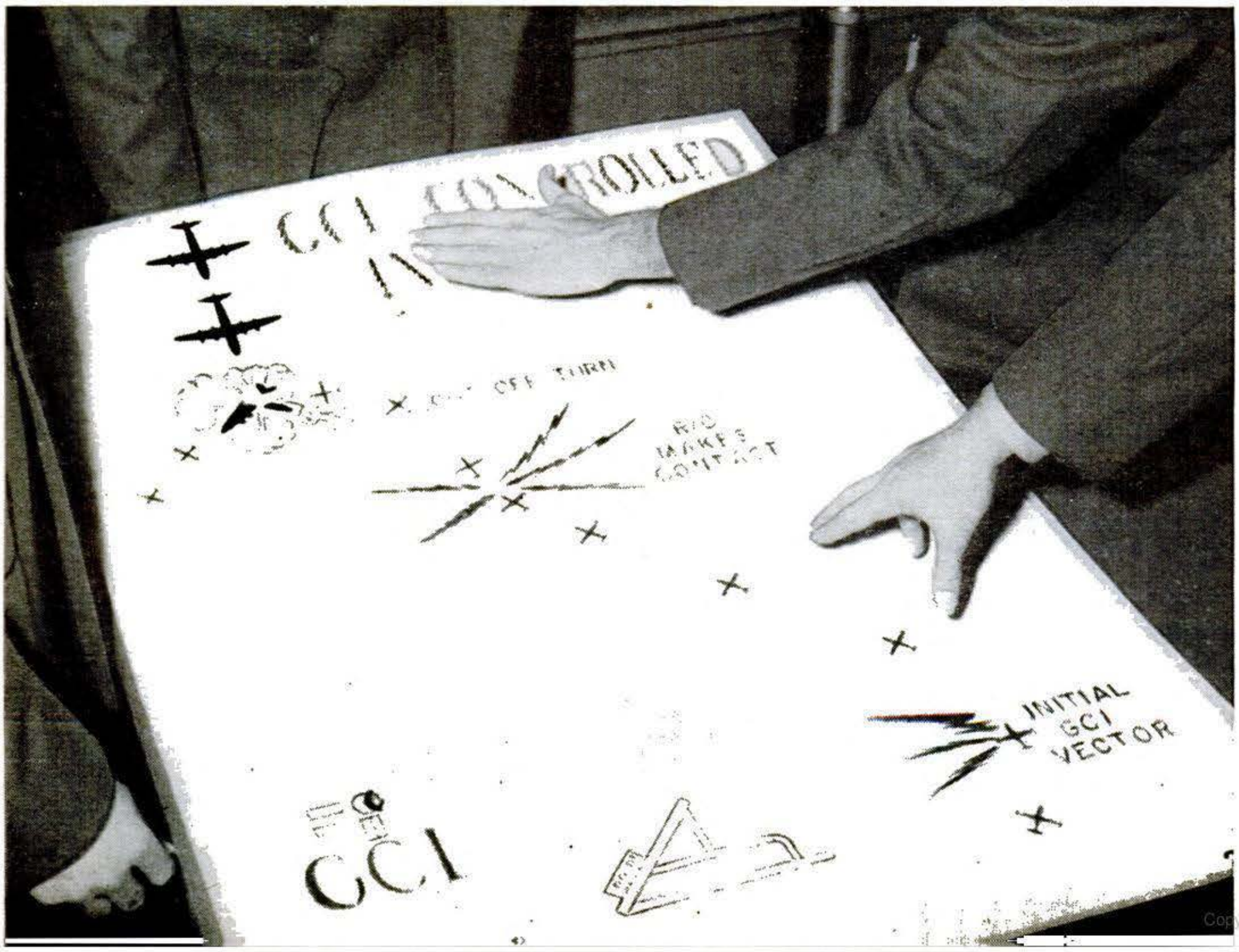
From a controller at a ground radar station comes the alert that sends them streaking aloft in minutes' time. In the air, they are headed toward the target by his radio voice instructions. The jet's radar observer takes over when he sees the target on his scope. Finally, when the jet is within firing range, the pilot picks up the target on a short-range radar of his own—and acts as the gunner to destroy it.

Pilot, observer and radar controller are the human links in a gigantic atomic-age system of radar warning and interception, thrown up by the Air Defense Command to guard the U. S. day and night against long-range air attack. Like spots on a Dalmatian dog, its radar stations and nearby interceptor bases dot the nation's map. Improved new interceptors are on order and some have been delivered.

For some time most squadrons will have Lockheed F-94s, now beginning to arrive at bases with increased power—and rockets. A later type, of which the first are showing up, is the F-89, with 16 five-inch rockets and six 20-mm. cannon. And the Air Force is going all out on a huge program to train the men who will fly them.

Mass production of radar observers has been under way at Connally since August of last year. Seven days a week, three times a day, they buzz around the balmy Texas atmosphere in B-25s converted into flying classrooms. Veteran radar men of World War II's night-flying Black Widows and

HOW ENEMY BOMBER is intercepted is shown on chart. Controller at Ground Controlled Interception (GCI) starts jet toward target. Then jet's radar observer (R/O) takes over.



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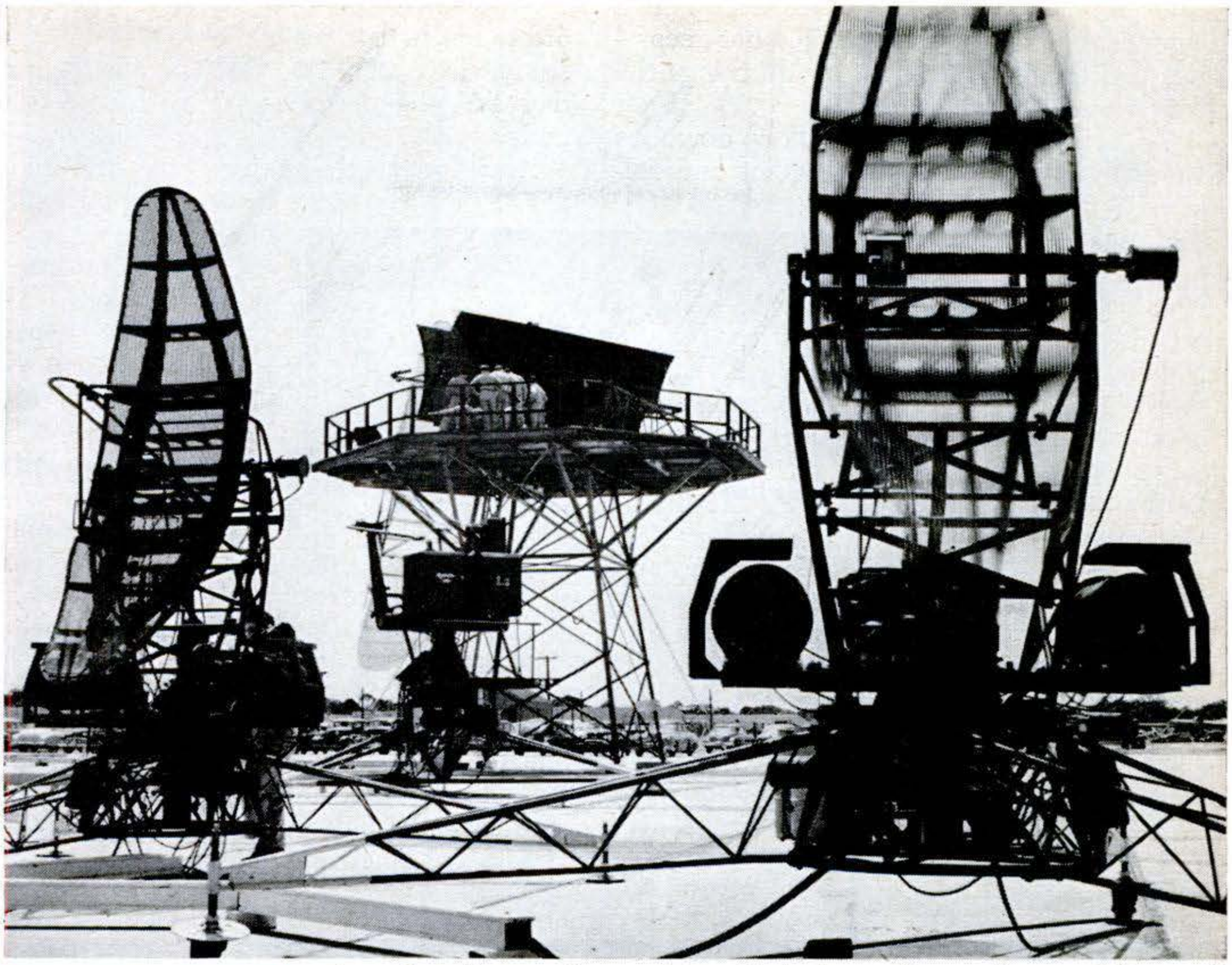

GROUND RADAR STATION gives alert that sends jet planes streaking aloft to investigate any unidentified plane. It may be an airliner off course. It could be an enemy A-bomber.

Beaufighters, recalled from civilian life to serve as instructors, are giving a course superior to any they ever had themselves.

The 25-week training program qualifies cadets for observer's wings and commissions. So many volunteer for it, before or after enlisting as airmen, that Connally gets the cream of the crop. All are in their early twenties. They average 3½ years in college. Most have had a fling at some profession. In the first group at Connally, one was a practicing lawyer, one an anthropologist, one a former smoke-jumper, another had a master's degree in theoretical physics.

Crammed into their training course are 465 hours of basic military training, then 426 hours of intensive study, and finally 138 hours of flight training, including 18 mis-

FUTURE RADAR OBSERVERS get 426 hours of academic training at Connally Air Base. Below, members of a class learn the meaning of the lines and symbols on a weather map.

LEARNING the intricacies of navigation, a cadet at Connally solves a problem with the aid of a dial computer. Other courses give him a grounding in electronics and radar.

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sions in the air. It's the shortest trip to a commission and to jets—but it's not recommended for those who like to do things the easy way.

To see what it's like, I flew down to Connally, picked out one student and followed him through the whole routine—our friend Floyd Few, who happened to be the first to finish his training in the air. A slender black-haired, good-looking kid from Taylor, N. C., he'd graduated from North Carolina State, enlisted in the Navy in World War II, and got into Annapolis by competitive examination. He dropped out to take a post-war job, but after Korea he put in for cadet training, re-enlisted and waited his turn. Called to Connally, he found he'd bought himself a package.

Zigzag lines mark new wings for radar man.

Up at five in the morning, young man. Dress and police your quarters. Have breakfast. Race off to classes. Assemble for lunch. Rush around the base to more classes all afternoon. Then drill. Then supper. Then study. Taps at 9:30. Do it again the next day and the next, always with something added.

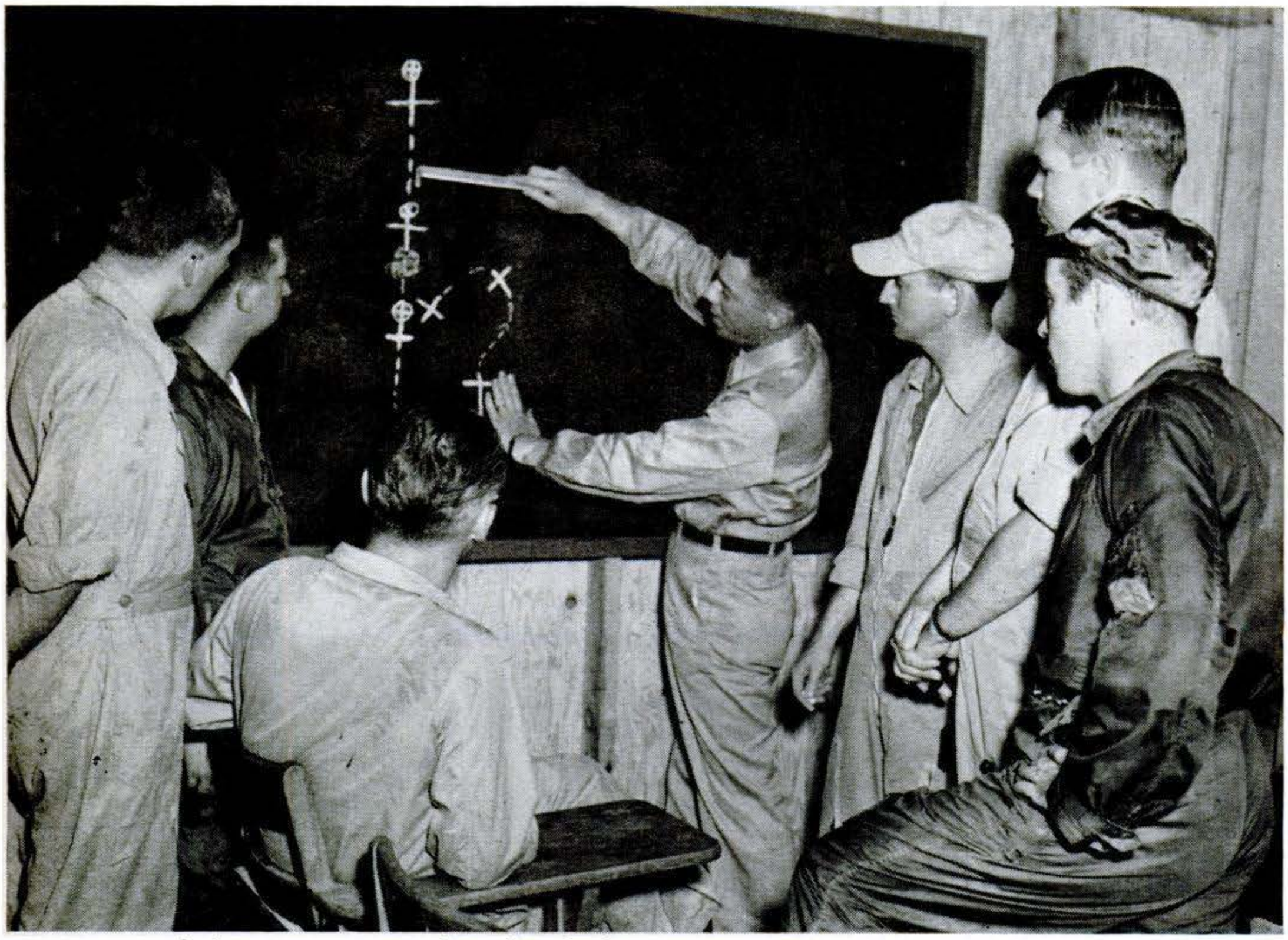
And for good measure, the traditional hazing for all fourth classmen:

"You'll march to your classes, Mr. Few." "Give yourself orders for each move." "Forward march." "Left face, march." "Right face, march." "Turn square corners."

Then, after evening chow, he stood stiff as a ramrod on the commons, taking orders from upperclassmen:

"Pull in your chin, Mr. Few." "Wipe off that smile, Mr. Few." "Give the radar observer's code, Mr. Few." "Are you confused, Mr. Few?" Anything he said was wrong, of course. Long military drills were the penalty. Floyd didn't mind so much. He'd been through it all before as a plebe.

[*Continued on page 206*]



CHALK TALK helps instructors plan the day's problem for students who will board B-25s, serving as flying classrooms, to be put through their paces in practice interceptions.

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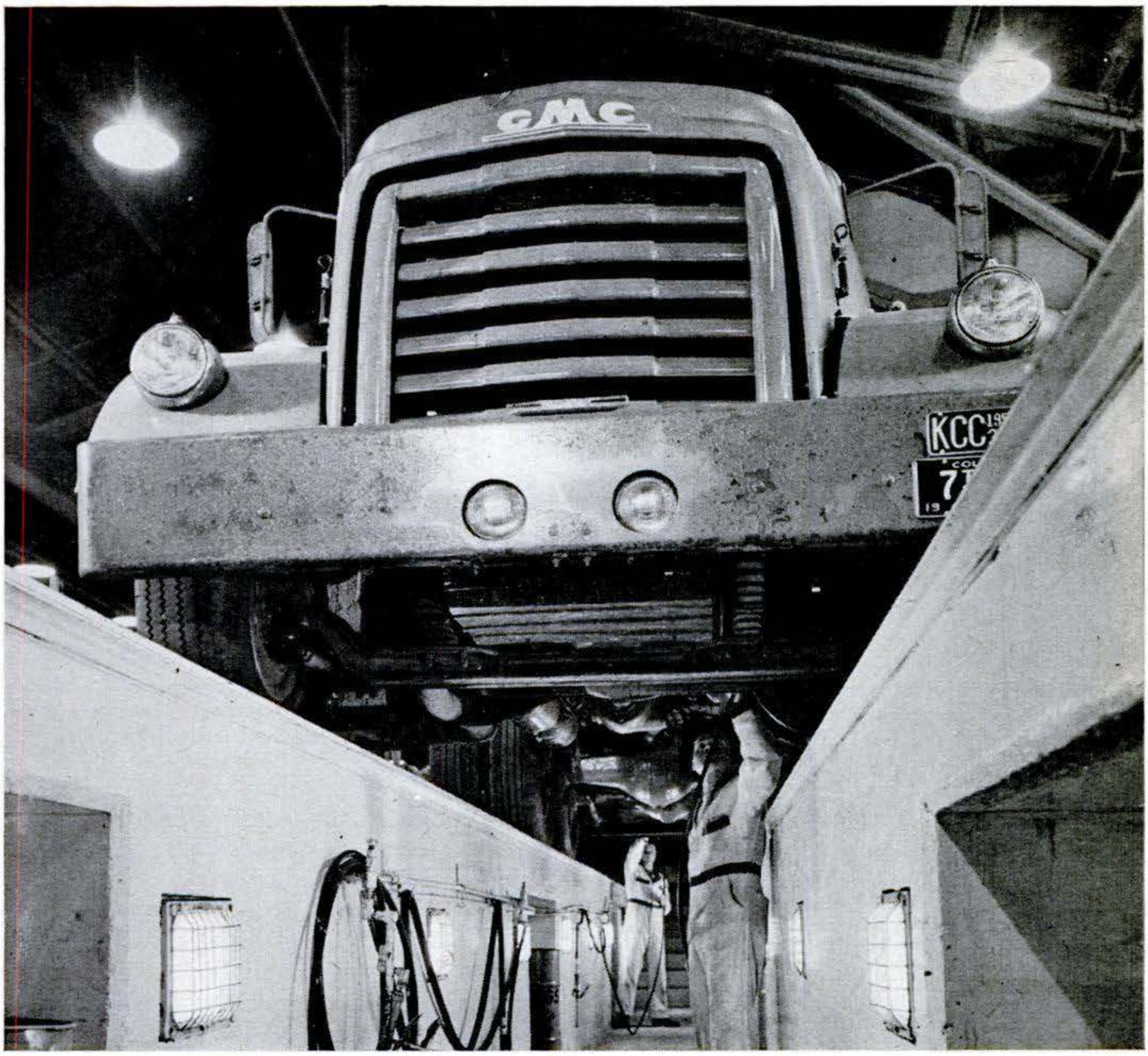

In a block-long lubrication pit, hoses supply grease and motor oil from buried storage tanks.

They Call It the World's Best Truck Garage

The gates never shut in this super-service center. Complete checks take four hours, major overhauls 48. It pays off in speed and safety.

By John Wesley Noble

JACK RIESING mates tires. He also builds donkeys, cures "sick horses," reads smoke signals to keep within the law, and installs coat hangers in truck cabs to please finicky drivers. Sometimes he chases huge tow trucks 200 miles off into Wyoming ground blizzards to rescue stranded rigs.

Riesing, 41, a slender, professorial-looking mechanic, is the new super of the huge maintenance shop of Pacific Intermountain Express at Denver. It has been selected by *Transport Topics*, published by the American Trucking Associations, as the best motor-carrier garage in the United States for a

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BIG, BRIGHTLY LIGHTED servicing shop is one of many that make up sprawling PIE garage in Denver, where every part of a tractor or trailer can be adjusted, repaired or replaced. Floors are radiantly heated against Denver's cold winters. Garage is staffed with 200 men.

fleet of more than 700 vehicles. Many experts call it the world's best truck garage.

When Riesing "mates tires," he sees that all on one truck are identical for balance. The "donkeys" he builds are the hostling type, shown in use in one of the photos. The "sick horses" he cures are ailing trucks.

HOSTLING DONKEY, developed by PIE, hauls huge trailer through spray wash. Rigs are cleaned on every trip east and west—cutting down rust and the need for paint jobs.

And "smoke signals" must be "read" to make sure the exhaust stacks don't belch more smoke than the law allows.

PIE drivers work relays of approximately 250 miles each over the sprawling system from San Francisco and Los Angeles to St. Louis and Chicago, but the massive silver-and-red rigs chaingang straight through on a never-ending schedule. By the magic of Riesing's 14-acre plant, through which rigs rumble at the rate of 50 a day, PIE's 276 tractors maintain an *average* of 25 miles an hour, 24 hours a day. That includes shop time, emergency road stops, and such feats as pushing fully loaded vans over 7,135-foot Donner Summit during blizzards.

Shop Could Build a Whole Truck

On every trip through Denver each truck and trailer is washed and serviced without even shifting its load. Any minor defects, such as rattling windows, a defective windshield wiper or faulty injector, are fixed at the driver's request. If a major overhaul is needed, 48 hours are allotted.

The Denver plant, a machinist's paradise of small specialty shops, does every bit of the giant line's repair and overhaul. Riesing's men assemble their own engines and subassemblies—fuel pumps, injectors, cylinder heads, piston and connecting-rod units. They have frame-straightening machinery, an elec-

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TRACTOR UNIT gets a quick check on the dynamometer—first step in four-hour trip through shops. Foreman in foreground is watching dials of analyzer, with driver's logbook in hand. Engine should deliver 124 horsepower when truck does 40 miles per hour.

tric shop for overhaul of generators, regulators and starters, a separate welding shop, sheet-metal and woodworking shops, and a paint-spray department. The machine shop has enough equipment to build a whole tractor or trailer.

Riesing also must worry about paint jobs, road breakdowns, tire wear in extreme cold and heat (PIE crosses deserts, too), brakes, first-aid kits, wheel alignment—a worry for every part a truck-trailer has. And PIE has 531 trailers in operation.

60,000 Miles Without a Breakdown

Preventive maintenance is the only answer. By treating the trucks like airplanes, including a complete engine overhaul at least every 125,000 miles, the company is tops in efficiency of operations. Some of its amazing records are: 5.29 miles per gallon of fuel for the entire fleet, 60,000 to 65,000 miles between road failures on trucks, up to 58,000 miles per new tire, and a remarkable 46,000 to 47,000 miles per recap.

Riesing learned 10 years ago, when he was a hostler and grease man in the shop, to listen carefully to the drivers and to follow their suggestions. Contented drivers have established PIE as a long-haul truck line noted for its drivers' courtesy and the best traffic-safety record in the country—with gold trophies to prove it. END

JACK RIESING plots 48-hour major overhauls at central dispatch board. Each tab on board is load of freight being hauled by PIE somewhere between Midwest and California.

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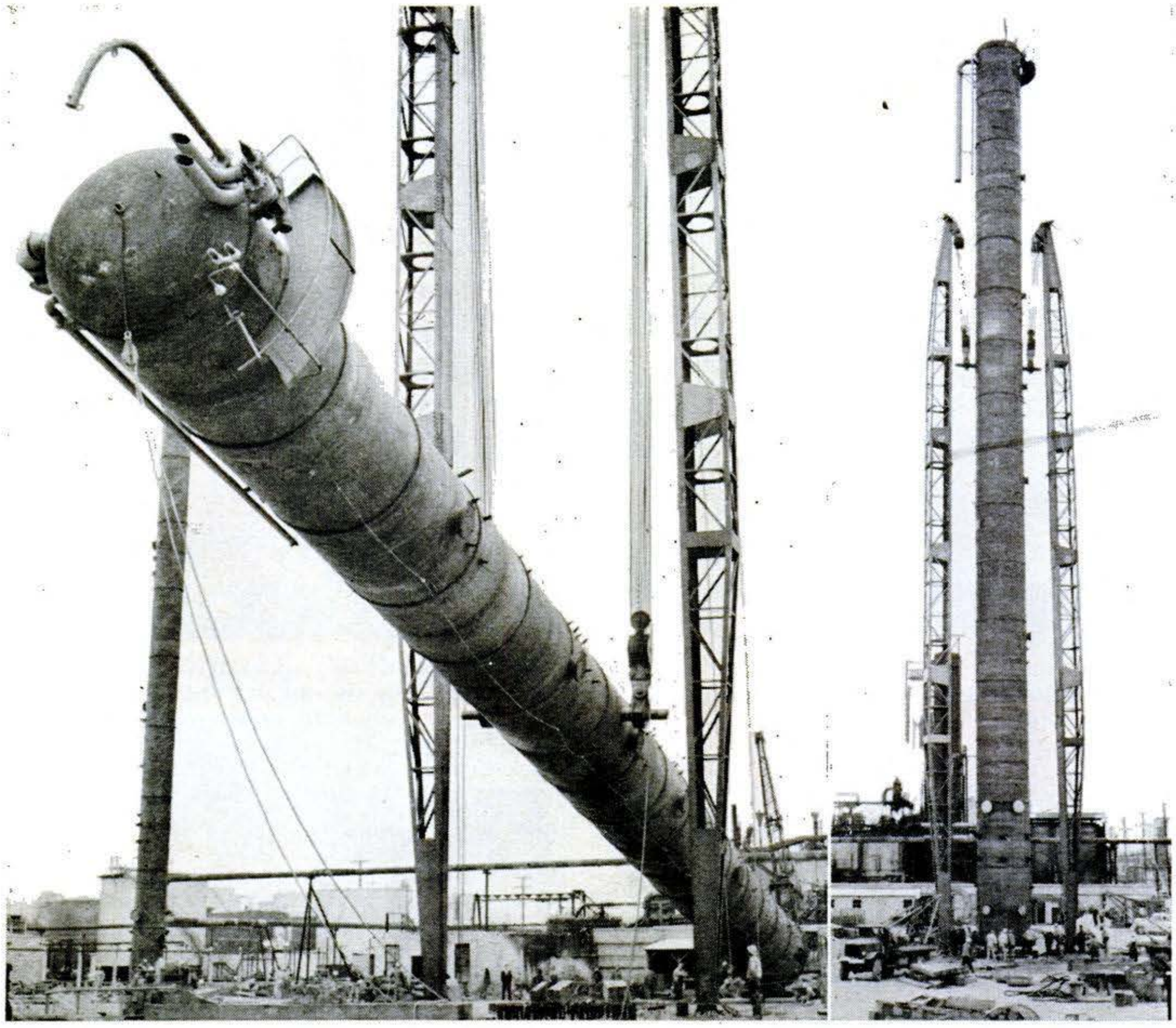
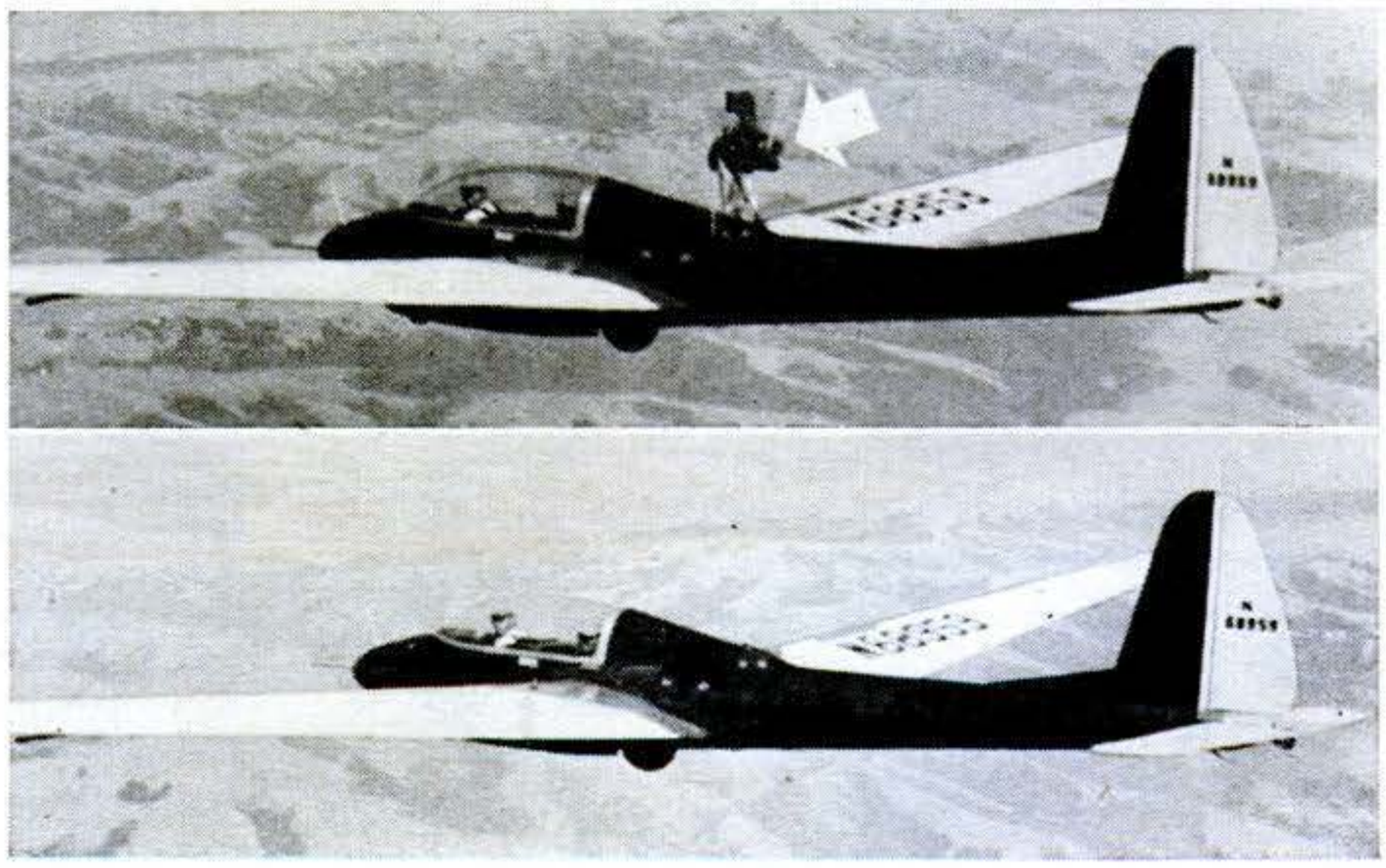


Tall Tower Takes to the Air

How do you stand on end a 200-foot-long steel column weighing 270 tons? Engineers raised this one by inserting a three-ton steel rod crosswise just above the center and hauling away with a Diesel hoist. The job took less than 2½ hours. Between masts braced by guy wires, the column starts up (left above) and ends in vertical position (right above). It will serve as a refining tower for aviation gasoline in the Standard Oil plant at El Segundo, Calif.

Disappearing Engine Boosts Sailplane Aloft Without a Tow

No TOW is needed to launch this self-powered sailplane. A 40-horsepower auxiliary engine (upper view) enables it to climb to 12,000 feet. Then the retractable engine disappears into the fuselage (lower view) and the pilot, Ted Nelson of San Leandro, Calif., enjoys the sport of sailing his plane as a motorless craft. Gliding in still air at 45 miles an hour, the lightweight sailplane loses less than 200 feet of altitude a minute.



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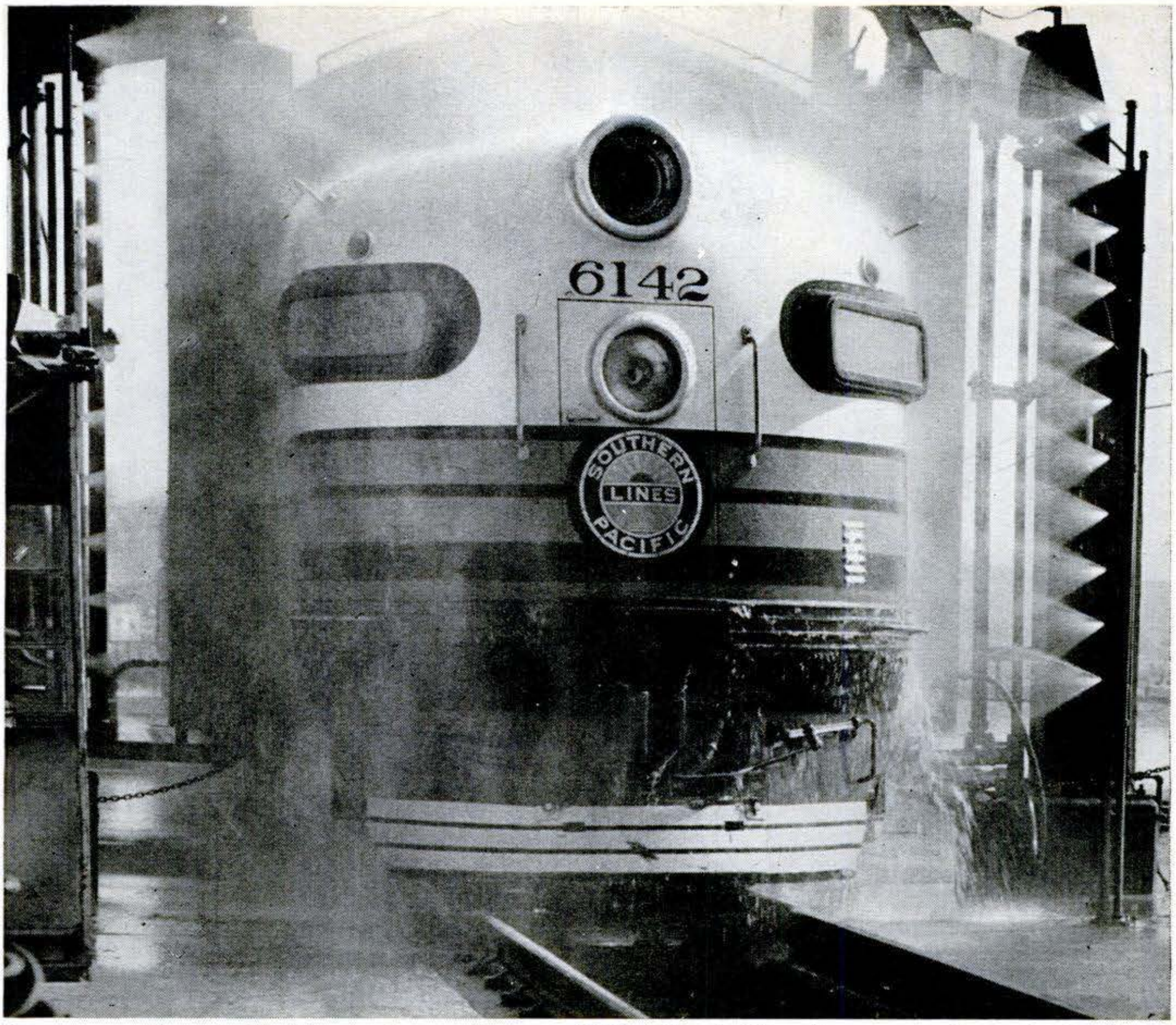

Spectrograph periodically checks on fitness of big Diesels like the one getting a bath above.

Light Waves Point Out Engine Troubles, Pronto

A 6,000-HORSEPOWER Diesel eased to a stop on the Southern Pacific's service tracks in Los Angeles. A mechanic swung aboard, drew samples of lubricating oil from its four crankcases and delivered them to a trackside lab. Technicians analyzed them with a spectrograph, as well as by other physical and chemical tests, and promptly reported the diagnosis:

"Hold locomotive. Cylinder liners in No. 3 engine are wearing. Check."

Spectrographic analysis now helps to avert breakdowns, delays and costly repairs. How it aids in heading off trouble is pictured on the following page. The spectrograph reveals the kinds and amounts of foreign particles in the oil. It does this by analyzing the light given off by the sample when burned, since each metal burns with its own characteristic colors—or "lines"— in the light spectrum.

In the example mentioned above, a heavy chromium line in the spectrum of oil from No. 3 engine showed wear of its chromium-plated cylinder liners. *(Please turn the page for more pictures.)*

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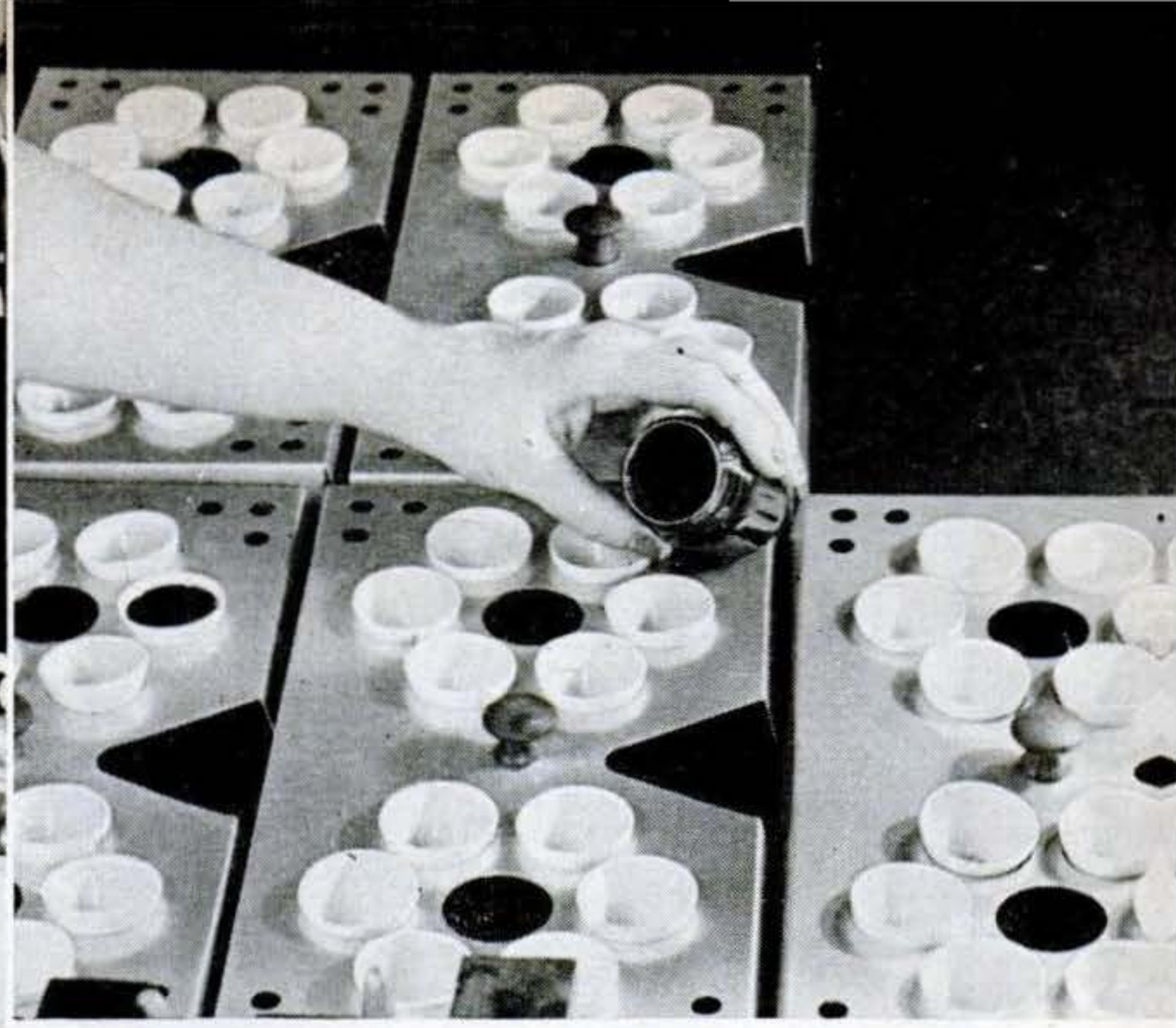
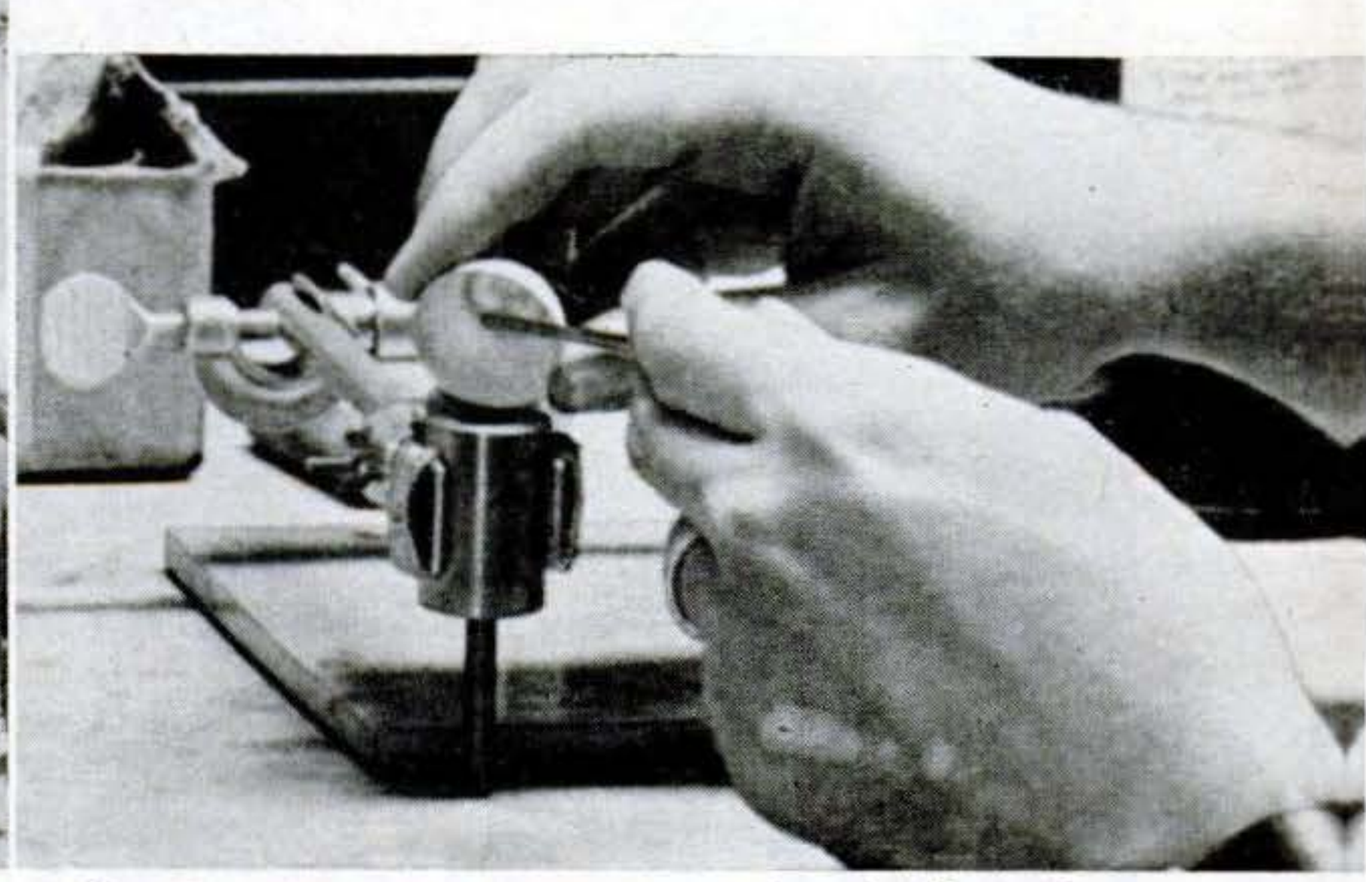


2 REDUCING OIL SAMPLES to ash, by heating in crucibles, puts them in suitable form to be tested with spectrograph. One of oil samples is being poured into crucible in view above.



1 MAINTENANCE MAN takes lube-oil sample from one of locomotive's engines. Bottled samples go to lab for spectrographic analysis, in addition to viscosity and chemical tests.

3 ASH FROM OIL SAMPLE goes into hollow electrode of spectrograph. When electrode is replaced in instrument and used to form arc, analysis of colors in arc reveals metals present.

4 TELLTALE LINES of color identify foreign metals. Density of line indicates quantity present. Silver could come only from wrist-pin bushings. Copper may have several sources.

5 MAIN BEARINGS of Diesel crankshaft show wear (outlined by markings) detected with aid of spectrograph. Timely warning enabled bearings to be replaced before failure.

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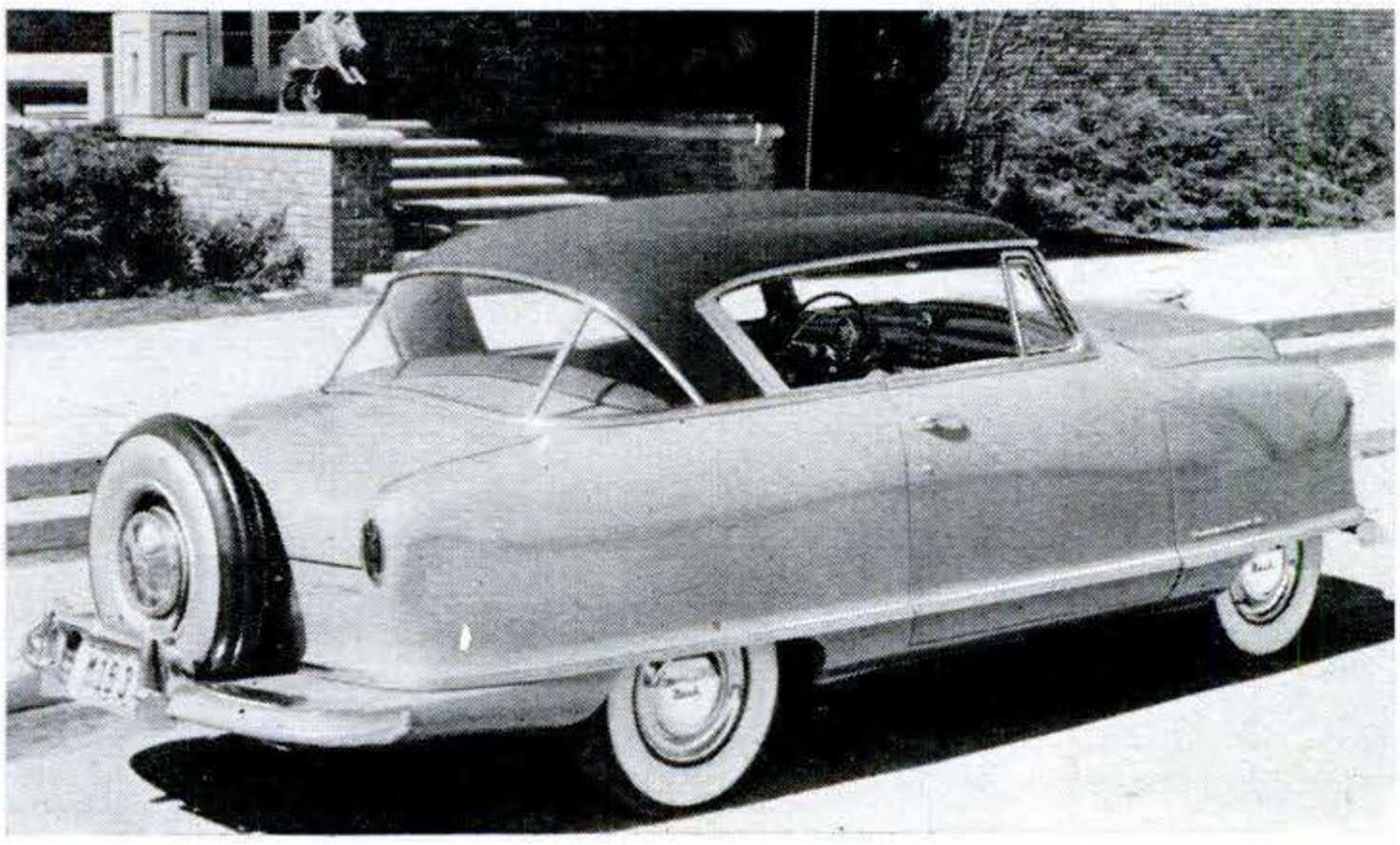
Jeep Hot Rod Charges Up Hills on Eight Wheels

WHEN a hot-rod expert gets through with a jeep, it can climb grades that would make a burro puff.

Vic Hickey of South Gate, Calif., developed a high-compression head for the civilian jeep above. That increases the horsepower 17 percent. Then he worked out aluminum adapter spools (right above) for dual sets of wheels. That improves traction and pulling power. The eight-wheeled result is shown on a test run up one of Los Angeles' steep hills.

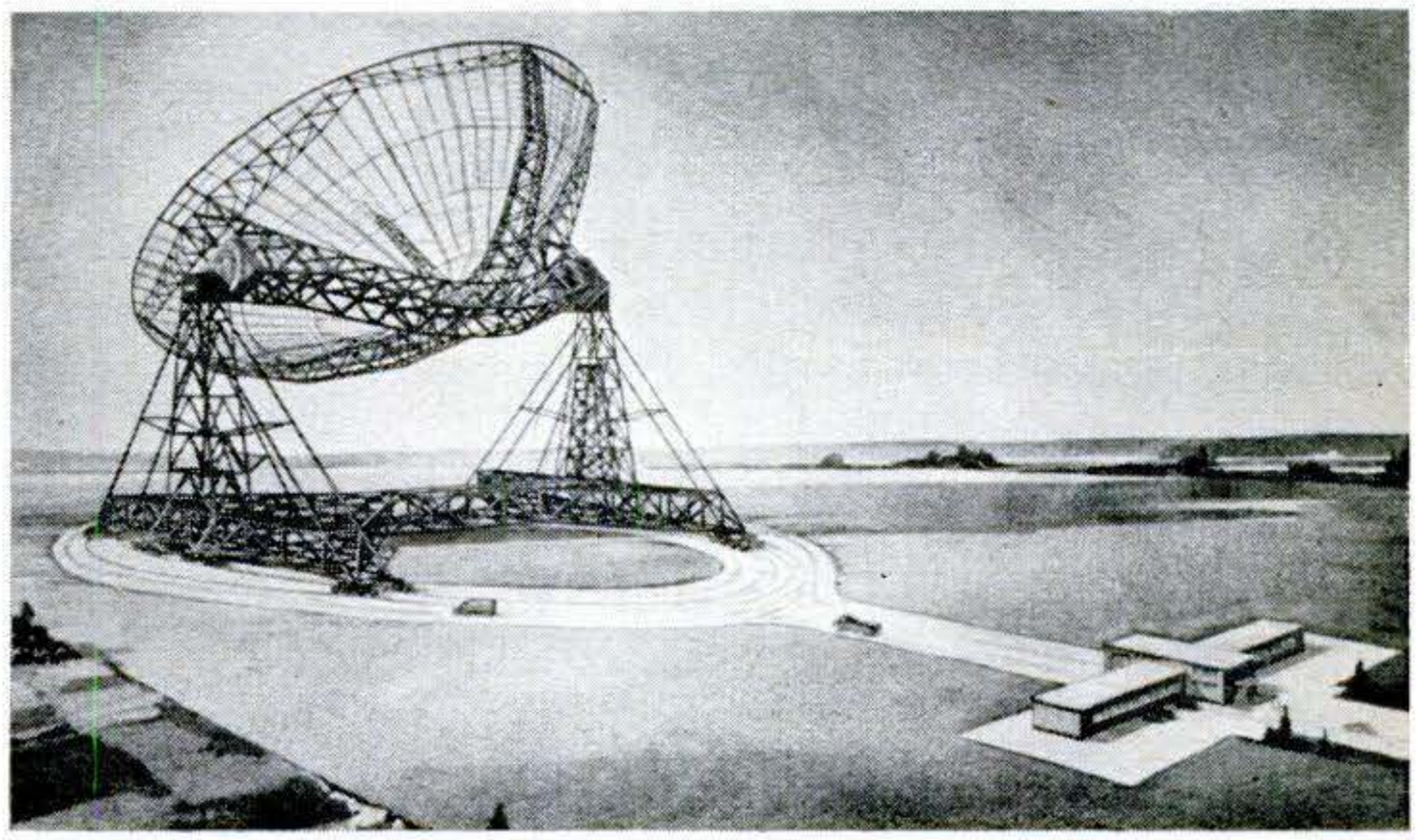
Low, Sleek Rambler Goes Continental with Outside Spare



YOU can now have the Nash Rambler hard-top convertible with a spare tire and wheel carrier mounted on the rear in continental style. Reclining seats that can be adjusted to four different positions, and Solex safety glass, tinted greenish-blue to filter out road glare and heat rays, are other optional features. Larger tires (6.40 by 15) are now standard equipment.

Huge Radio Telescope Will Hear Murmurs of Lightless Stars

THIS huge radio "telescope"—a paraboloid aerial 250 feet in diameter and weighing 1,270 tons—is planned in England. It will pick up signals sent out hundreds of years ago by stars dead of old age or too young to emit light. Uprights straddling a circular track will allow the aerial to be swung in any direction. It will take four years and $940,000 to build it.



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Rods Make High-Line Repair

LINEMEN no longer take down miles of high-voltage wire to repair splices. One by one, 12 preformed aluminum-alloy rods are wrapped over bad joints. In minutes, the line is back in service and the electricity is shunted through the rods to keep heat from building up in the defective splice beneath. Worked out by the Southern California Edison Co., the new method is said to improve conductivity across old splices 400 percent and more.

Meter Seeks Out Hidden Nails

Too many blowouts made Heinz Freund of Berlin turn inventor. For locating nails or other metal snippets embedded in his tires, he devised an electrical instrument (above) that works like a mine detector. When it is held against the tread as the tire is revolved, the presence of any metal within its electrical field is indicated on a voltmeter near the handle. He plans to market the tire saver in Germany for about $3.50.

Trash Vacuumed Off Roadway

CALIFORNIA highways are being cleared of litter with the giant vacuum cleaner above. Seated on the curb side of the vehicle, a worker guides the hose with a handle bar attached to its snout, sweeping it from side to side and lifting it over obstacles. To speed the pickup, men walk ahead, raking debris to the roadside. The Good Roads Machinery Co., Minerva, Ohio, makes the vehicle.

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Back-Yard Mechanics Build Racing Planes

Their midgets, swooping around a pylon at 200 m.p.h., put this year's air races practically in your lap.

By Douglas J. Ingells

IN A garage only a few blocks from where I live in Dayton, Ohio, a very secret project is in progress. You'd think my neighbors, Walt Buffington and Chester Bigos, were building a super A-bomb. They eye a stranger with deep suspicion and act like they feared a spy was lurking behind every bush ready to grab their idea and run.

But once you win their confidence, everything is okay. They trust you then with the information that they are building an airplane. It is a midget racer which they have

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BUZZING MIDGET cuts close around pylon at Cleveland airport in $25,000 Goodyear Trophy race. This year the top event will be Continental Motors Trophy race at Detroit.

dubbed the B & B Special. Their aim: to startle the world—and pick up some cash—in the big air races to be held at Detroit on Labor Day.

All the midget-airplane people are secretive like that. They are members of a very special cult with a code all their own. They'll help each other at the drop of a hint; they'll exchange engines, sell parts, lend money if they have it, even pool labor, for the common cause. But they'd shoot their best friend if they thought he was out to "steal" their idea.

Just Ordinary Guys

My neighbors, Walt and Chester, are typical of this strange postwar breed. They are also a couple of average Joes who, at first glance, look like ordinary American mechanics, which they are. Walt works on the flight line at Wright-Patterson Air Force Base; Chester in the Aeroproducts Division of General Motors.

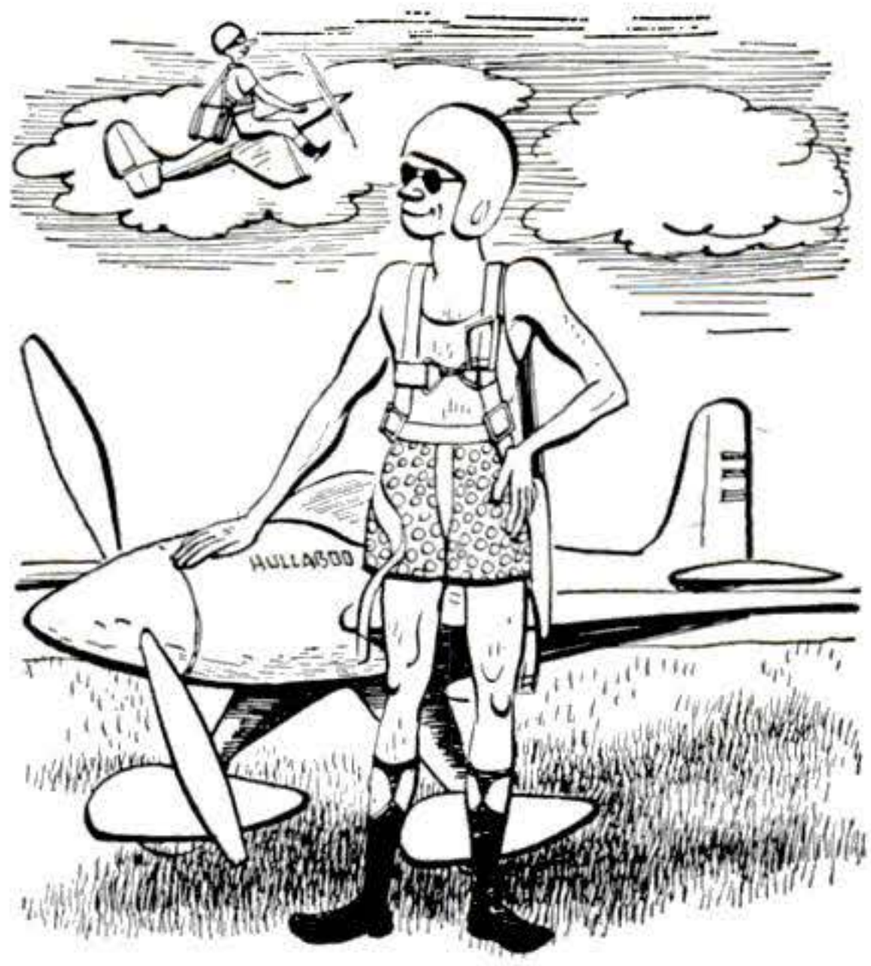
They're both married and they earn about $75 a week. Living expenses in this critical defense area just about eat that up, with nothing left over to support the B & B Special, a baby that is always in need of new shoes or something.

"We pick up extra jobs at the airports around here," Walt explains. "There's always somebody who needs a good mechanic. Every extra buck goes into the Special."

The B & B Special has been in progress for more than three years now. Originally, my neighbors planned it for the 1949 races. They almost made it but for the fact that the brakes went haywire just when Walt attempted a taxi test. The tiny plane roared into the air out of control, then smacked into the ground.

When Walt awoke 10 days later in a hospital, Chester was at his bedside to assure him there was nothing wrong with the basic design. The trouble was purely mechanical. All they had to do was raise some more money and build again.

So far the special has eaten up about $3,219 in cash money and about 1,200 hours of the spare time of two skilled mechanics. The labor of love averages 25 to 40 hours



a week for the two men, all on top of a regular eight-hour day in the shop, plus extra hours at the airports. It's a real heartbreaker and full of sacrifices, causing sleepless nights, domestic tensions—"You love that plane more than you do me!"

And, for what? By now Buffington and Bigos trust you enough to let you look. Theirs is a dream of a little airplane, trim and neat, all blue and yellow. It has a fuselage length of 17 feet, tubular construction with fabric covering. Its wings measure 15 feet from tip to tip. An 85-horsepower Continental motor drives a 60-inch propeller. The tiny cockpit looks too small for a grown man to get in.

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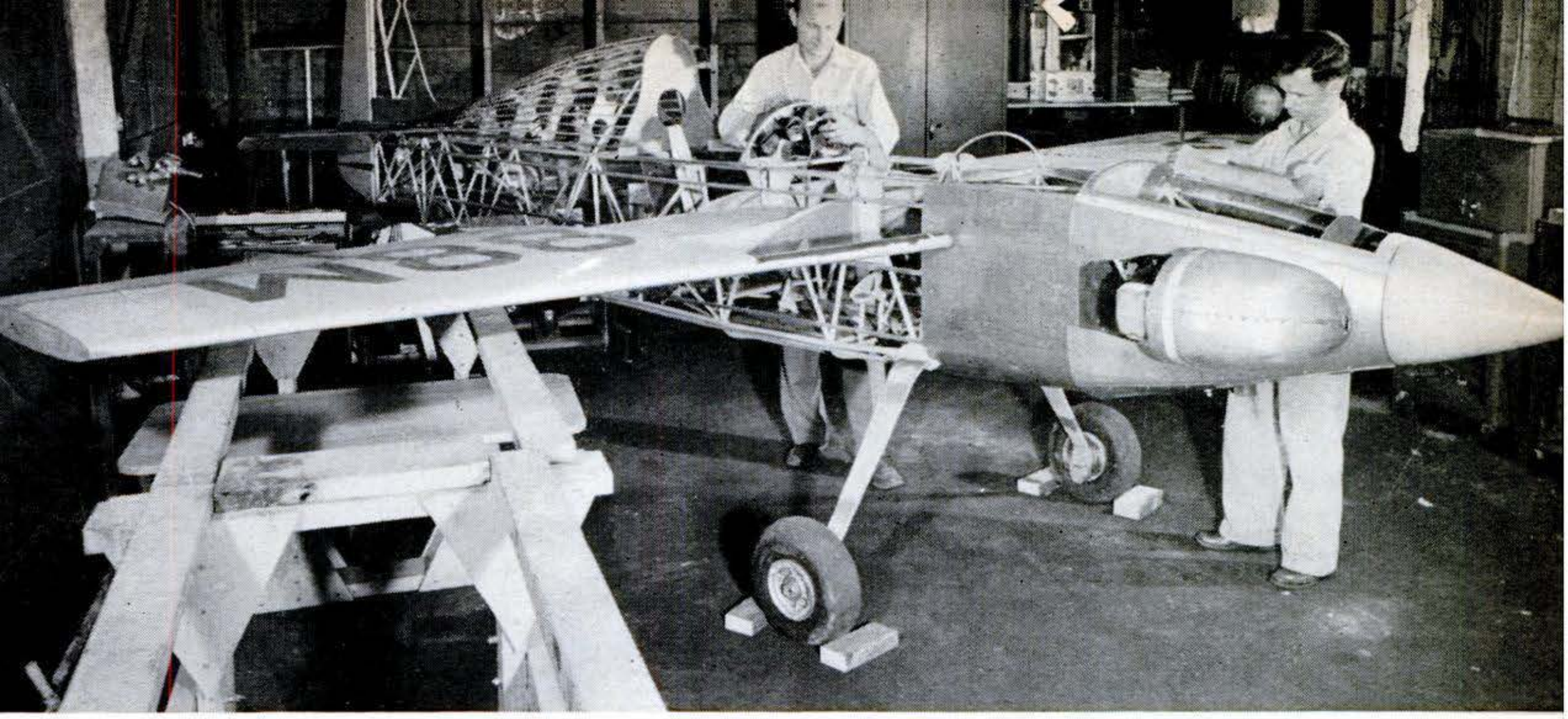


SECRET PROJECT: In back-yard garage, Chet Bigos and Walt Buffington (right) rebuild racer.

"You don't climb into it," Walter has his little joke. "You pull it on like a pair of pants."

There are exceptions, of course, but most of the midget racing planes are dreamed up and built by back-yard mechanics in small towns, young men like Buffington and Bigos, or, for that matter, like the Wright brothers, who were doing the same thing a half-century ago.

Many Enthusiasts Build Midgets

There are perhaps three or four hundred of them scattered around the country. Some of the creations will never get off the ground; some will circle around the pylons of the 2½-mile closed course once or twice and be forgotten. A few will share the big money at the National Air Races, others will settle for second-string meets at Miami, Chattanooga and Reading. Others will hit the county fairs and airport shows.

Bill Falck, for one, boasts that he hasn't missed a midget race of any importance since the sport was revived five years ago. Back in the Thirties, in his early teens, Falck started hanging around airports in the New York area. He did odd jobs around the hangars, taking pay in flying time. Then he got a plane of his own and a base at Warwick, N. Y. In 1947 he picked up a secondhand racer, redesigned it to his own tastes, flew it to Cleveland and won a consolation prize. That was enough to make him an addict for life.

A roster of the midget racers would include an assorted company of enthusiasts. Jimmy Miller, for instance, owns a super-

FINISHED JOB: B & B Special, ready for National Air Races, has a wingspread of 15 feet.

market, but takes time out to build and fly his own racer. Prof. Robert Routenstrauch of Bucknell University is a designer of midget planes. Ralph Thompson Jr. pays for his plane out of wages as a garage mechanic. Thirty employees of Lockheed Aircraft have put $45,000 into three small ships, representing about the biggest single stake in this so-called "poor man's sport." And there's Neal Loving, the Negro lad from Detroit, who lost both legs in a glider crash. He flies it hot and fast in a snappy, revolutionary gullwing midget he designed.

Racers Are Serious-Minded

The midget racers don't take kindly to the nickname "aerial hot-rodders." They'll tell you that theirs is a serious purpose—to improve the quality of small planes. Dean of the racers is Steven Wittman, a former school teacher from Oshkosh, Wis. Now pushing 50, he wraps up his wisdom in a simple package thus:

"All the secrets of this business are in the bulletins of the National Advisory Committee for Aeronautics. All you have to do is read them. They are your Bible of aerodynamics for midget builders."

The history of modern midget racing traces straight back to the closed-course speed races which began in the early 1920s. These developed into the National Air Races, which were great fun until the planes got so big and fast they lost their appeal as a spectator sport. They were invaluable, however, for testing fuels, designs and assorted gadgets under severest conditions.

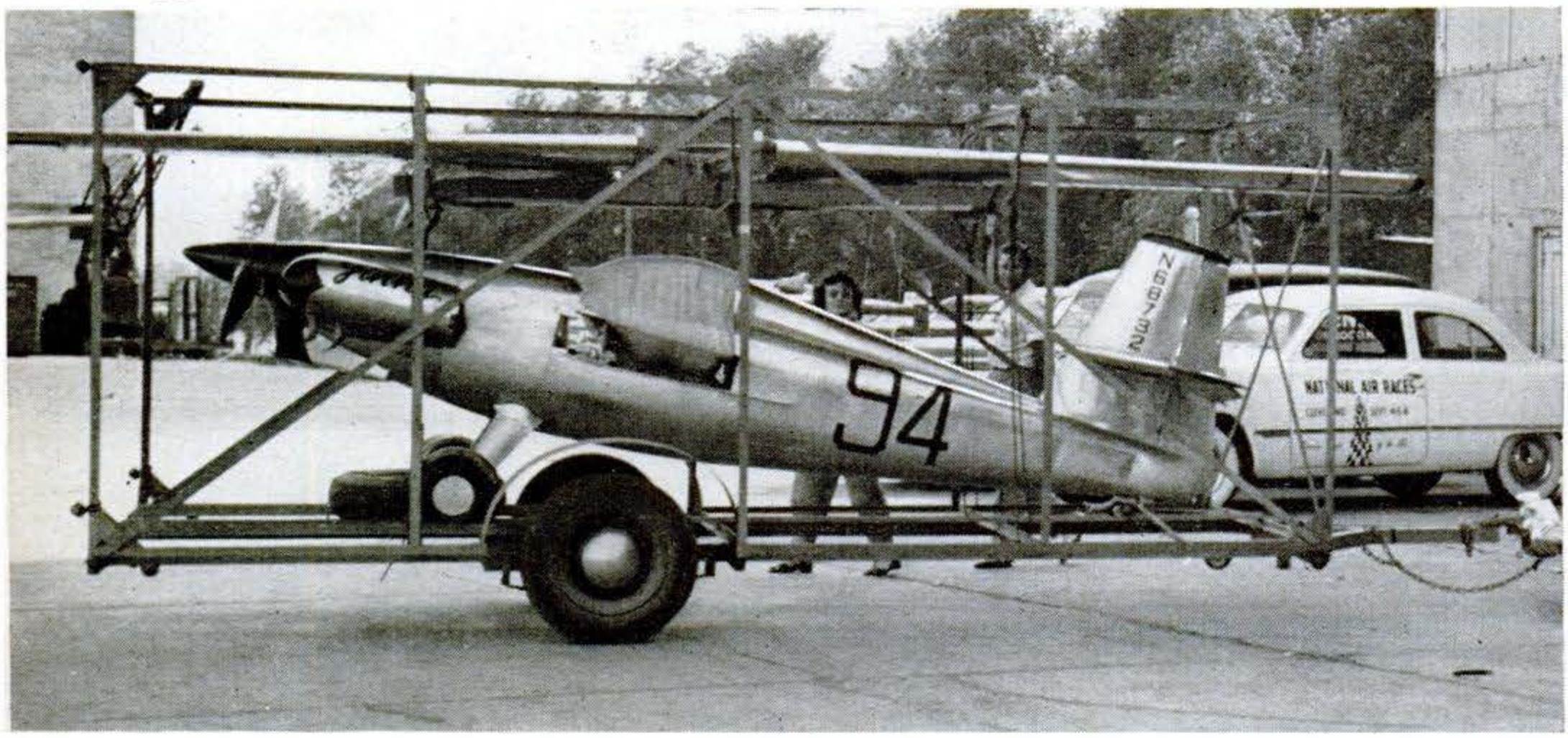
Abandoned during the war, the races were revived in 1946—with a difference. War-surplus fighters were used in what proved to be an unpopular form of racing. "The only thing these war planes prove is how much guts a pilot has to kick 'em wide open," was the comment of one veteran pilot. Another veteran, Bill Odom, crashed into a bungalow with a revamped P-51.

This was the final blow. Cleveland turned thumbs down on big-plane racing, welcomed the midget racers in their stead.

Benny Howard and Art Chester had seen the handwriting on the wall. Back in 1939 they had assembled a group of pilots and had drawn up plans for a small-plane speed classic to be run over a small, closed course at low altitude, in front of the stands so spectators could watch the whole show.

[Continued on page 218]

Wings clipped for highway travel, Al Foss's homemade midget tows easily behind family sedan.



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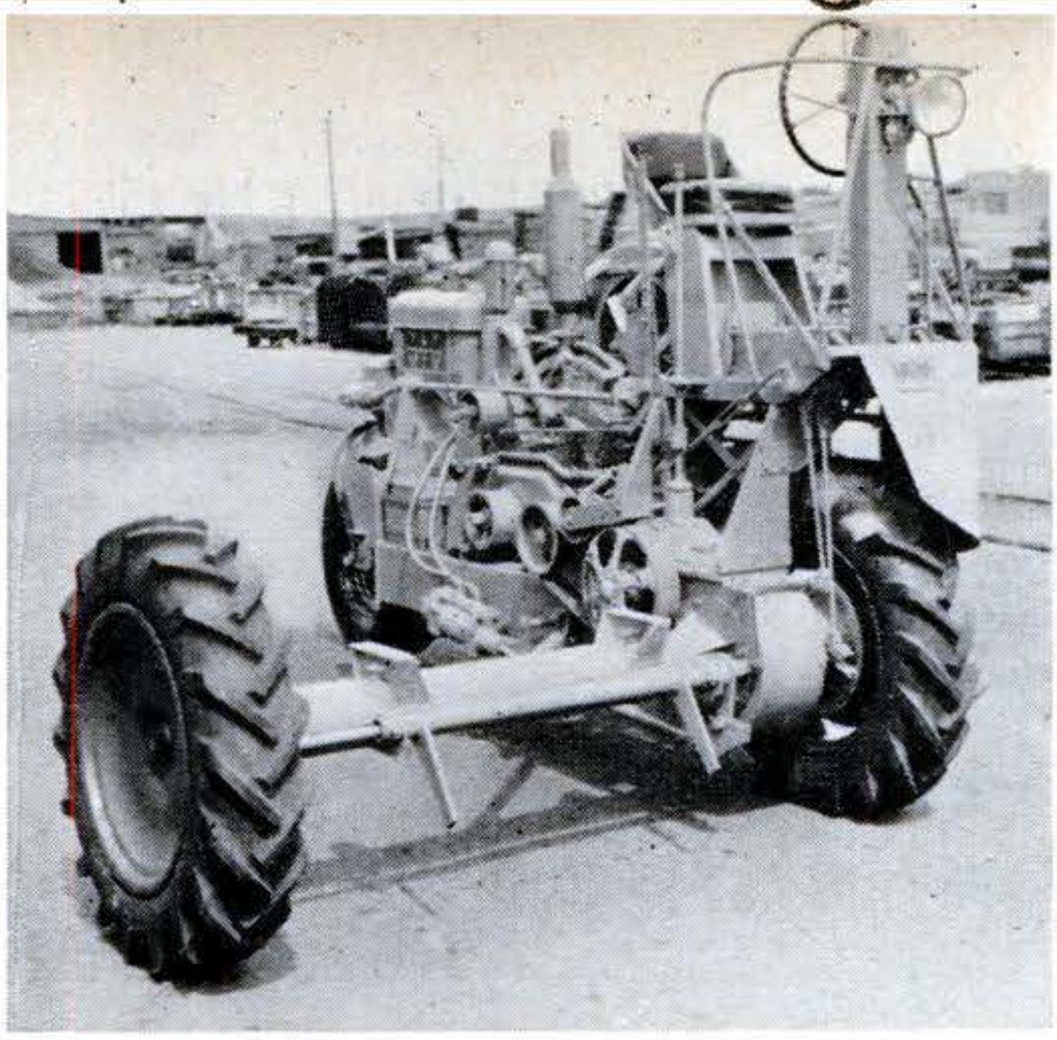
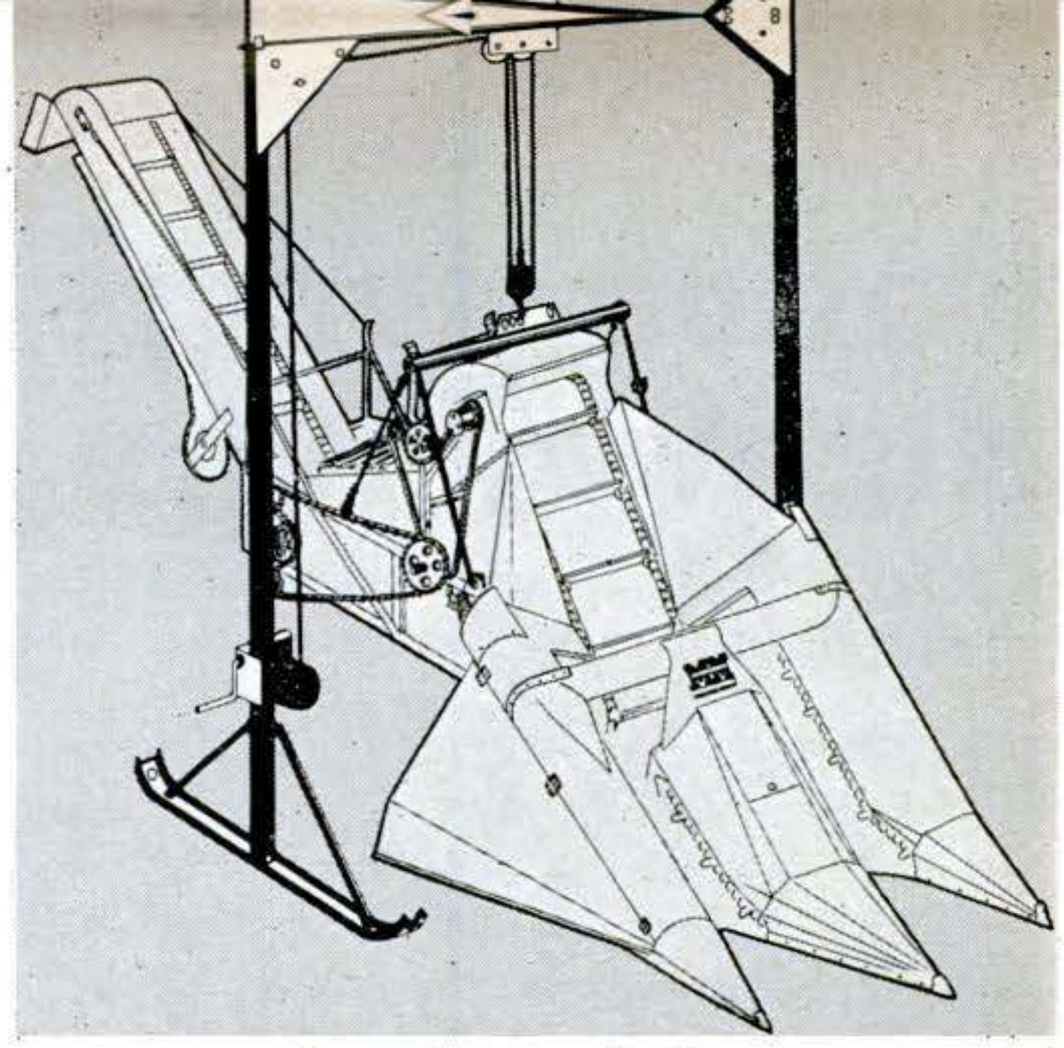


TRACTOR UNIT provides motive power for multi-purpose farm machine, shown in use as a corn picker and husker in photo below. Easily interchangeable attachments adapt new machine for this purpose or for use as a combine.



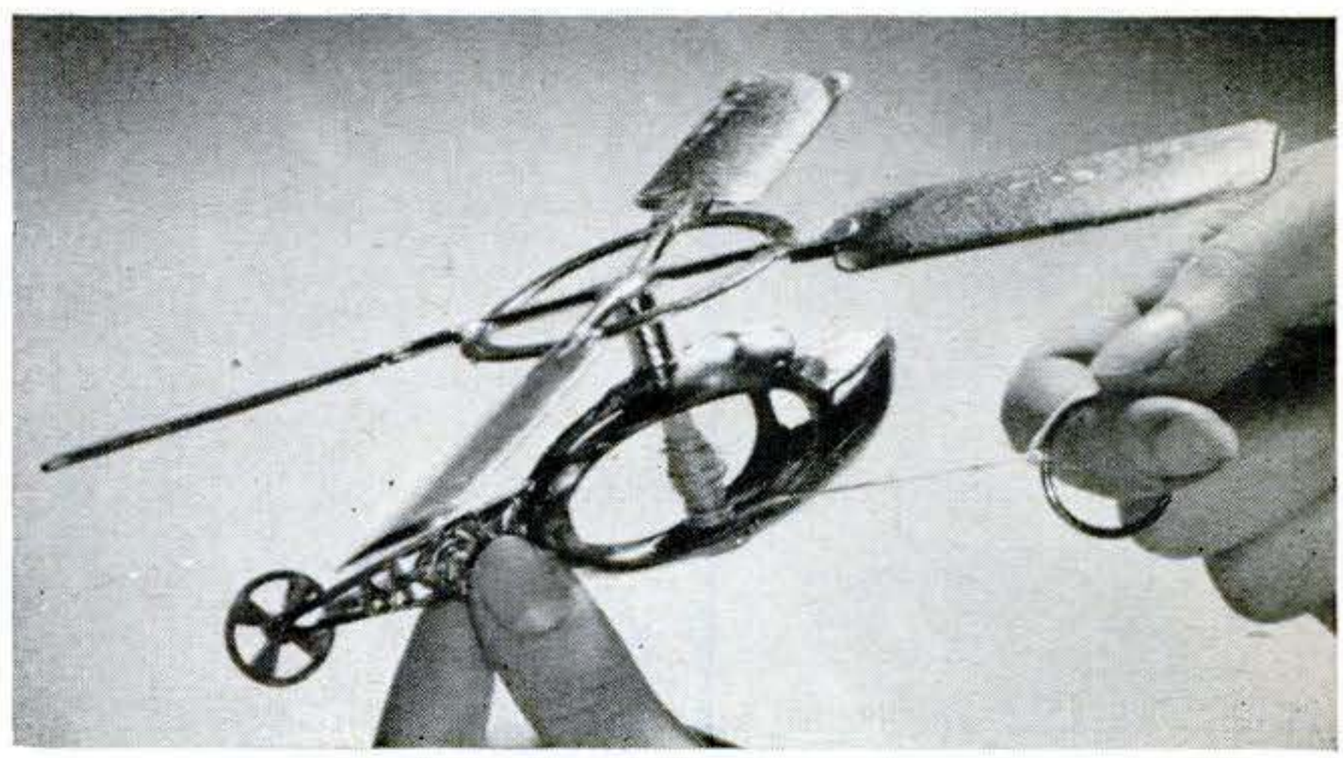
HUSKER, ready to be attached to tractor unit, is shown suspended from cable and sling that make a simple task of changing attachments. A three-wheeled dolly (not shown) serves for storing attachment that is not in use.

Quick-Change Farm Machine Harvests Wheat or Corn

CALLED the "harvester of tomorrow," a new self-propelled farm machine may be used either as a combine in wheat fields or as a two-row picker and husker in corn fields. Attachments for each purpose fit on a tractor unit having a four-cylinder 38-hp. engine, and are interchanged by removing only one bolt, two slip pins and two spring-release pins. A cable hoist and sling make light work of handling them. The nine-foot combine has a hydraulic lift that sets the cutting height anywhere between two and 24 inches. On the husker, snouts are adjustable to five floating positions. The Uni-Harvestor is made by Minneapolis-Moline Co., Minneapolis.

Toy 'Copter Looks Real

HERE'S a toy helicopter that really looks like a helicopter, especially as it buzzes high overhead. When a child winds it with a string like an old-fashioned top and pulls the cord, it takes off with rotor spinning. Called the Skyro-copter and made by Marxman Pipes, Inc., New York City, it is said to fly high as 300 feet.



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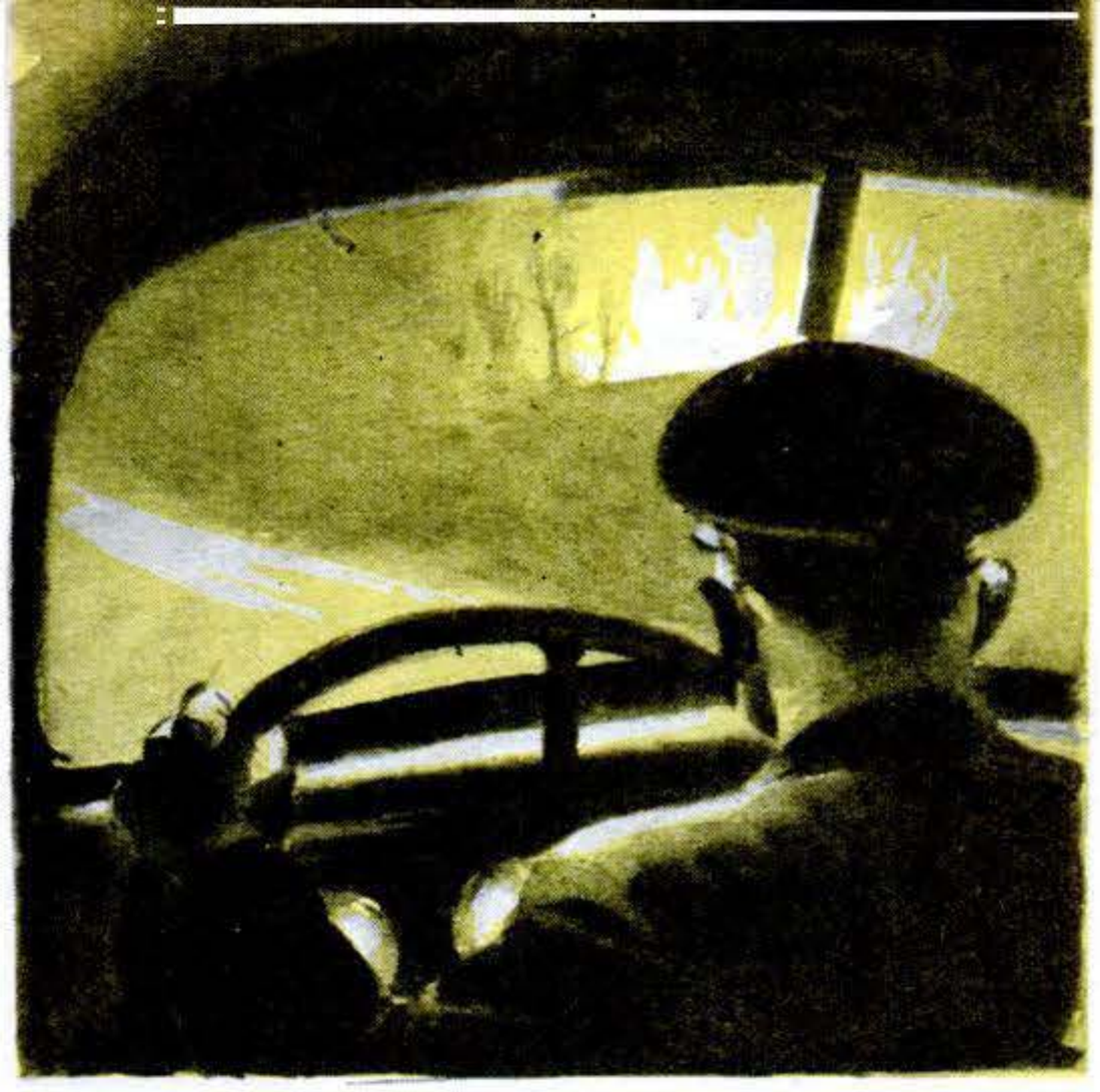
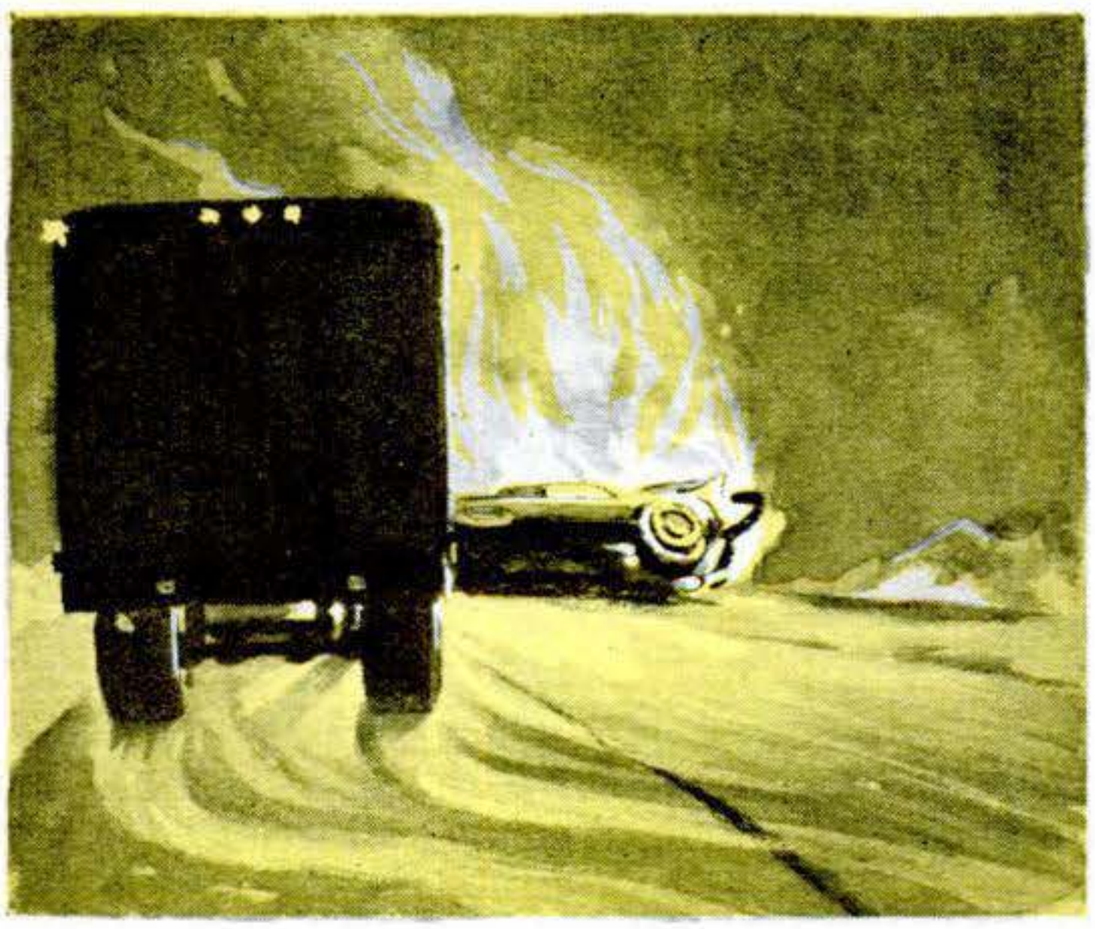
Nation Honors Highway Hero

A storybook adventure helped make this unassuming trucker Driver of the Year.

HUSKY, blue-eyed Allen C. Sagerhorn of Barnesville, Minn., is a good truck driver, and a modest one, too. In 11 years he hasn't had an accident. And after he risked his life in a daring rescue, he didn't even leave his name. That's how he won the American Trucking Association's 1952 title, visited the President, and appeared on radio and TV. Then he went back to work.



1 IT HAPPENED AT THREE A.M. January 18, 1951. Sagerhorn was pushing 45 on the Fargo-Minneapolis run when he saw fire by a bridge.



2 DESPITE ICY ROADS—the temperature was 30 below—he hit the air brakes and skidded his giant rig. A car was overturned, blazing.

3 COATLESS, Sagerhorn leaped out of the cab into the frigid night and ran to the flaming wreck, heedless of the danger to himself.

4 THE DOOR WAS JAMMED. Seconds meant life or death to the unconscious man trapped inside. Sagerhorn ran back for a jack handle.

5 BRAVING THE SCORCHING BLASTS, he managed to pry open the door just before gasoline-fed flames devoured the car.

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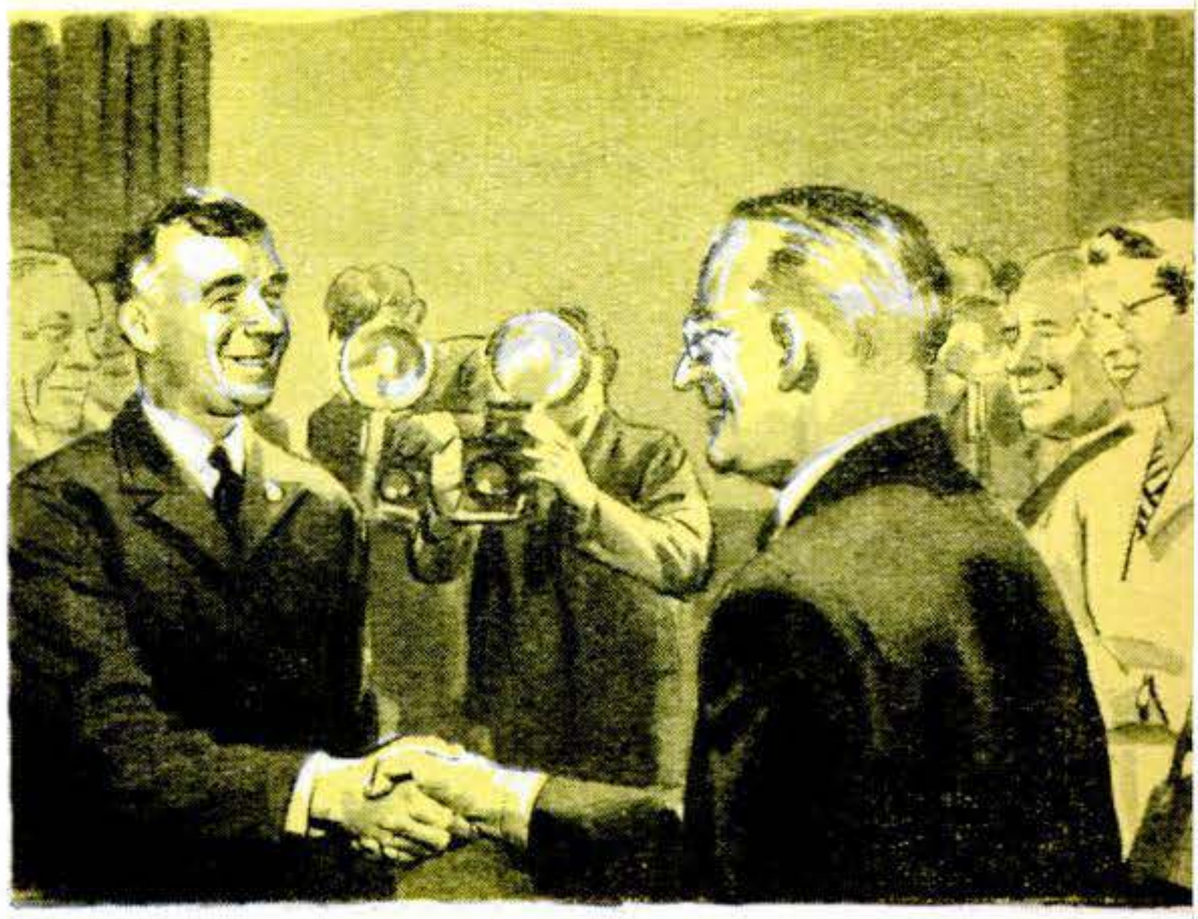
6 **THE MAN HE SNATCHED** from the inferno was Rodney Lenzmeier, 21, who had fallen asleep at the wheel on his way to work at the stockyards in South St. Paul. Lenzmeier had crashed into the bridge abutment and been knocked out as his car had burst into flames.

7 **LIGHTS WERE APPROACHING.** Sheriff N. J. Neumann and Deputy C. M. Nelson had spotted the fire and sped to the scene.

8 **THE OFFICERS** put Lenzmeier in their car to rush him to the hospital. Thanks to Sagerhorn's quick work, he was not badly burned.

9 **WITHOUT EVEN GIVING HIS NAME,** Sagerhorn hopped back into his truck and drove off. It was a month before he was identified.

10 **VOTED DRIVER OF THE YEAR,** the 37-year-old hero was congratulated by President Truman at the White House on May 7, 1952.



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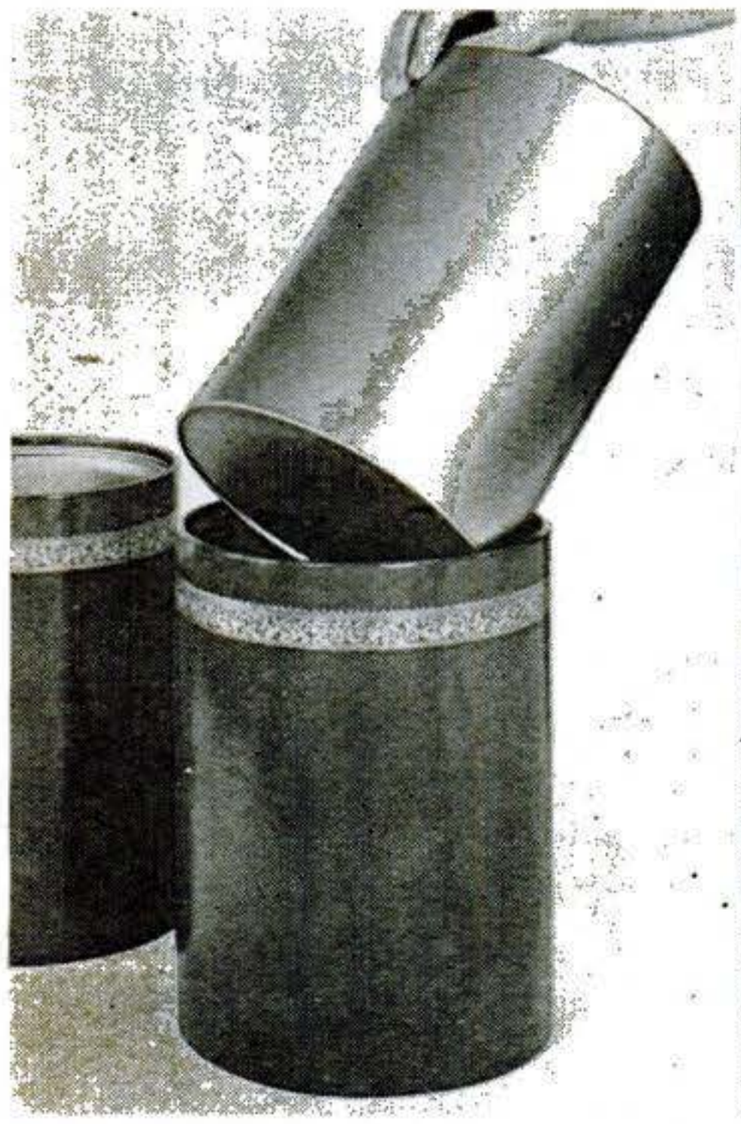
Aids to Modern Living

1. Portable Hammock. The wooden frame of this hammock folds so that you can carry it along in the car or store it in a small space during the winter. When set up, the wide legs prevent tipping and turnbuckles at either end allow for a tight- or a slack-hanging hammock. The Lumite plastic hammock dries within a few minutes after rain.



4. Lined Basket. You can drop a greasy paper napkin, an apple core or even a smoldering cigarette into this leather wastebasket without worrying. In place of the usual cloth lining, it has a removable, fireproof liner made of steel.

5. Mixing Faucet. You can control both volume and temperature of water flow from this faucet with one hand. Lifting the lever turns it on. Twist to the left—the water is hotter; twist to the right—it's colder; press down and it shuts off.

6. Shell-less Egg Cooker. No need to juggle hot eggs to remove the shells when they are prepared in these heat-proof glass cups. Dropped into the cups without shells, they're lowered into hot water for soft cooking, then brought right to the table.

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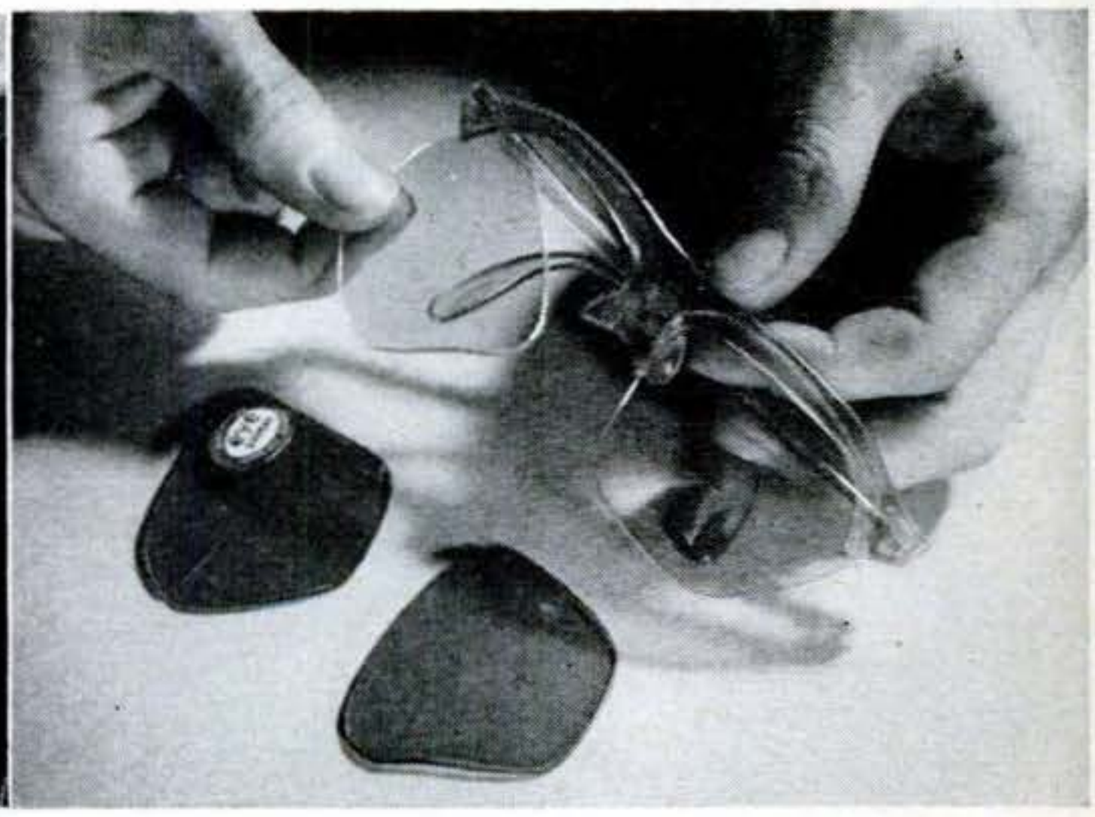
2. Water Pockets. One pocket of this plastic apron holds suds, another rinse water, the third cleaning cloths for window washing. With tools stowed in the pockets instead, it's handy for gardening.

3. Kneeling Shower Head. This combined shower head and tub filler adjusts to various angles. Raise Adjusto high for showering an adult, lower it a bit to spray youngsters or to shampoo your hair.

7. Suds Dispenser. Fill the Squeeze 'N Wash with soapy water, press the sides of the plastic bottle and suds are forced through a nylon-bristled brush. A quick swish and windows or dishes are spanking clean.



8. Interchangeable Lenses. Remove the green sunglass lenses in these Eye Savers, insert the yellow ones and you have night glasses that are said to make television watching easier on the eyes.

Further information on these products can be obtained from: 1. Houtz & Barwick, Box 225, Elizabeth City, N. C.; 2. Ett-Barr Co., Box 401, Pasadena 18, Calif.; 3. Milwaukee Flush Valve Co., 301 E. Reservoir Ave., Milwaukee 12; 4. American Binder Co., 230 Taaffe Place, Brooklyn; 5. Moen Valve Co., 6518 Ravenna Ave., Seattle 5; 6. McKee Glass Co., Jeannette, Pa.; 7. Anro Products Co., 4610 N. Ravenswood Ave., Chicago 40; 8. Eye Savers, Inc., 115 N. George St., York, Pa.

Please turn the page for more aids to modern living.

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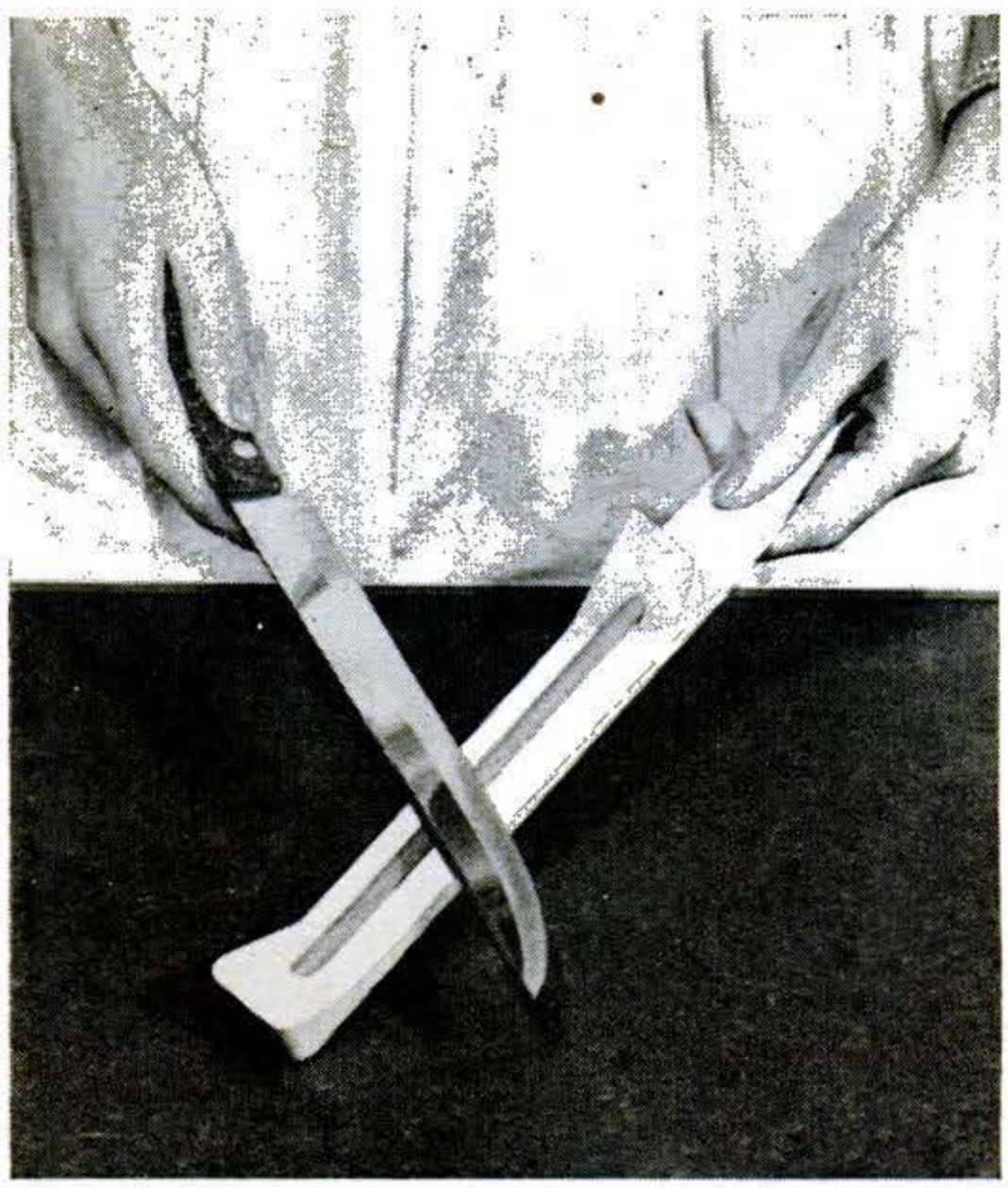
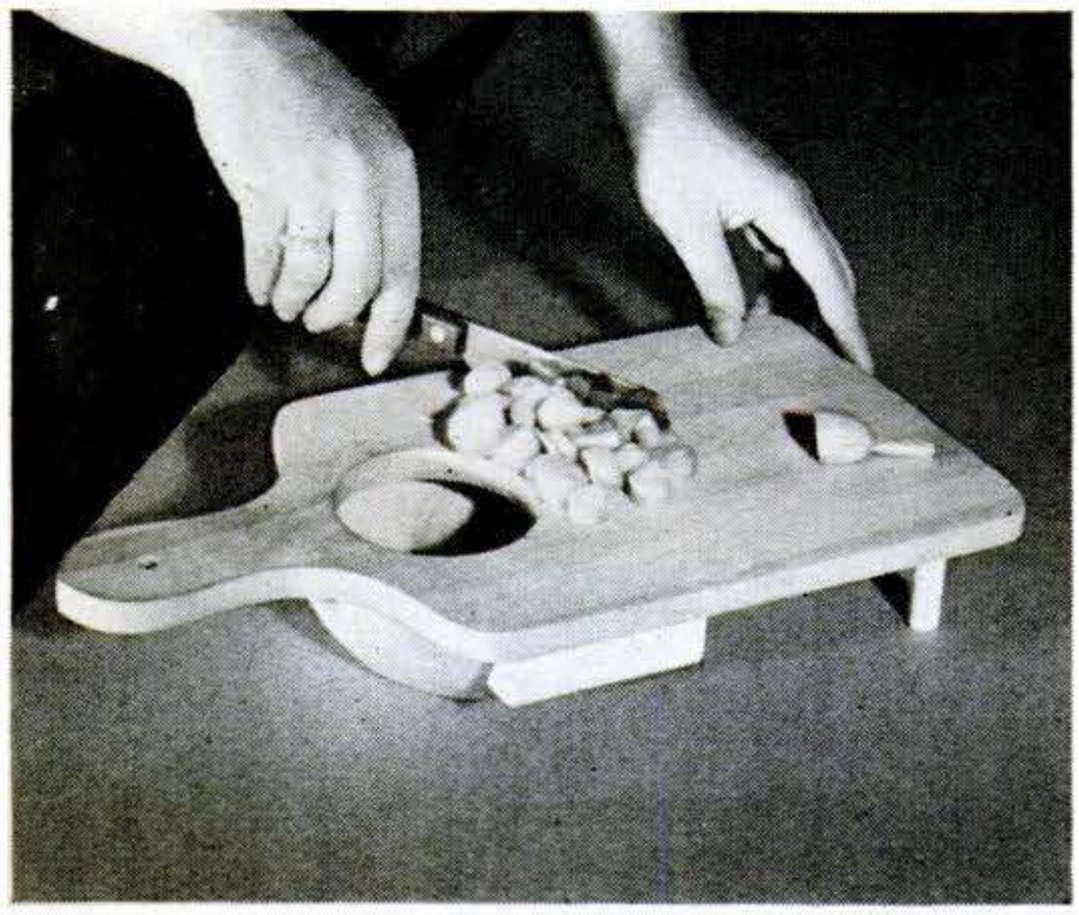
MORE Aids to Modern Living

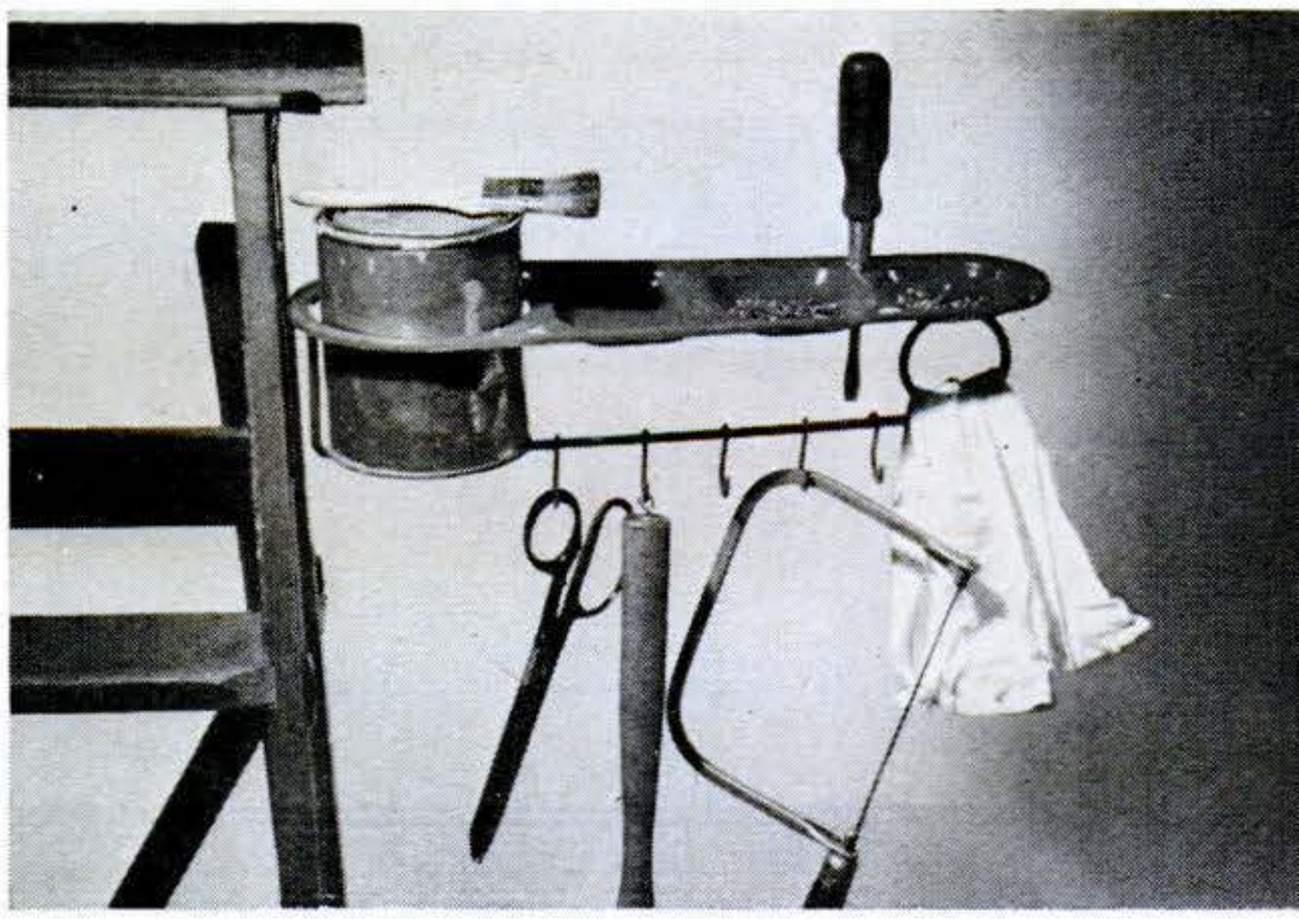


9. Knife Hone. It doesn't take an expert to put a slick edge on a knife with Sharp Stik. The wooden holder in which it is set keeps the blade at just the right angle for sharpening against the steel.

10. Reading Rack. Here's a lap tray that makes light work of reading heavy books or magazines. For use when seated in a chair or in bed, it adjusts to a level position for eating or writing, folds flat for storage.



11. Chopping-Board Bowl. A six-inch wooden bowl slides in and out beneath the hole in this board. Peg legs at the opposite end make it stand level. Chop vegetables on the board, scoop them into the bowl through the hole and nothing is lost overboard.



12. Ladder Caddy. It's always when you're up the ladder that you find the hammer is on the floor. Arrange your tools on a holder like this and they'll stay within arm's reach. The unit slides on and off a base plate fixed to the ladder.

Further information on these products can be obtained from: 9. Robeson Cutlery Co., Perry, N. Y.; 10. J. J. Felice, Box 103, Ridley Park, Pa.; 11. The Krebs, 45 Broad St., Westerly, R. I.; 12. Tetfoam Corp., Ambassador Bldg., St. Louis 1.

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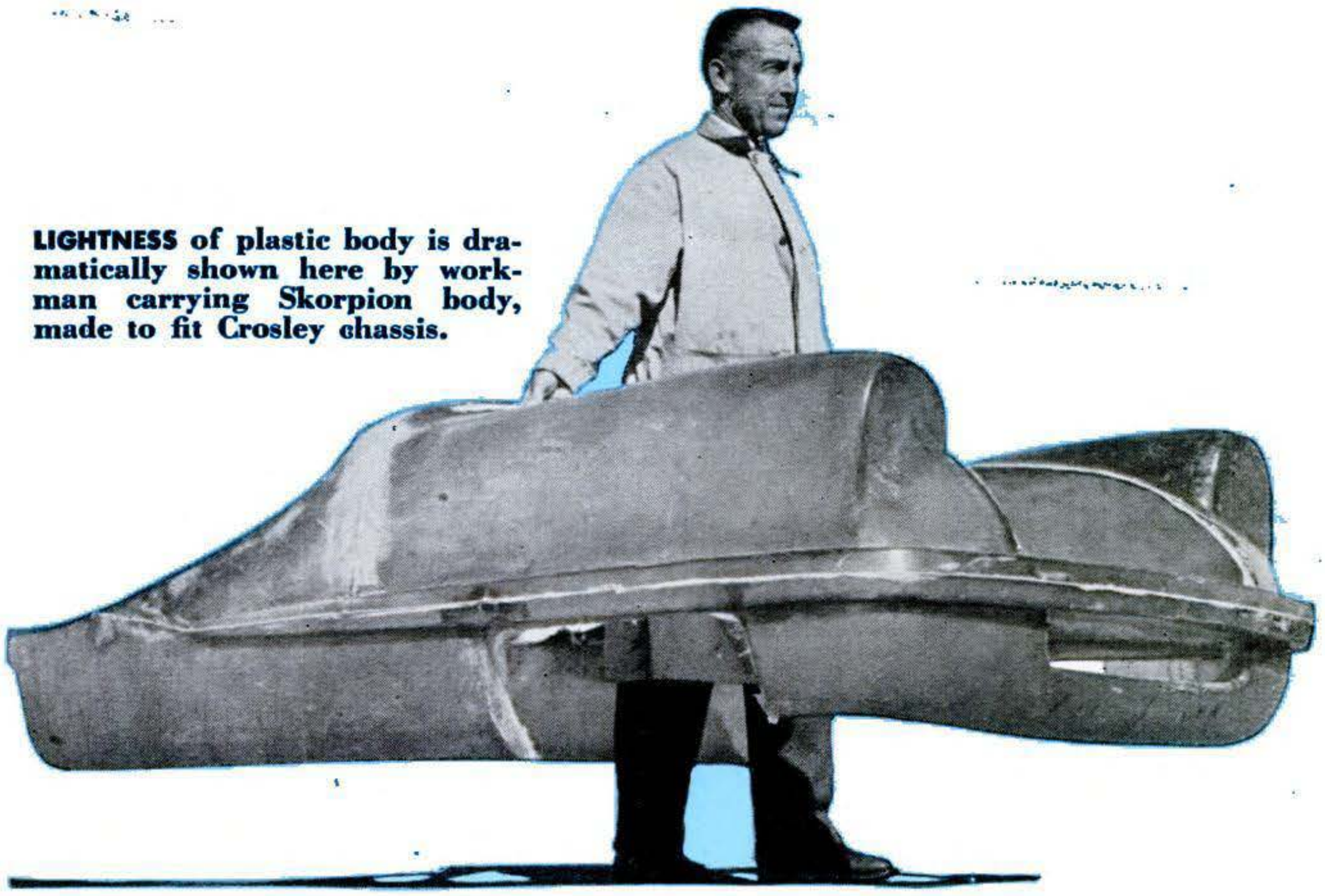

LIGHTNESS of plastic body is dramatically shown here by workman carrying Skorpion body, made to fit Crosley chassis.

Auto bodies of reinforced plastics have lots of good points but they are not ready to move from the custom class into mass production.

By Carl Konzelman

Henry Ford once took an ax
And gave the body forty whacks.
When he saw what he had done,
He gave the fenders forty-one.

NEEDLESS to say, the body that Henry took an ax to belonged to a Ford. It was 1941 and the pioneer of mass-produced autos was demonstrating his newest baby—a plastic auto body. When it absorbed punishment without a whimper, auto owners everywhere pipe-dreamed an early flow of indestructible plastic cars from Detroit's assembly lines.

Eleven years and 25 million passenger cars later, the auto industry trots out its best still clothed in steel. Plastic cars—custom jobs, ghost cars for display—have nudged the headlines briefly, then vanished. Now such handsome sport bodies as the Glasspar, designed by William Tritt (PSM, Mar. '52, p. 148), and Skorpion (PSM, May '52, p. 172) raise the question again: What about plastic cars?

The answer isn't simple. Plastics have come a good way since Henry Ford's time. Originally, plastics were used only for small objects because high pressure and heat were required to form them. Today new resins like the polyesters have changed the picture. They set with comparatively low pressure and heat—some without any pressure at all and at room temperatures. And now glass fibers can be used to strengthen these plastics much as steel rods strengthen concrete.

Glass Must Be Pretailored

The glass comes as a woven fabric—which is expensive—or a mat of fibers. Either type must be pretailored. The glass can be cut into pieces that fit the mold, or "preformed"—chopped up and sucked onto a form roughly the shape of the finished product.

Next step is to combine the glass fibers with the plastic resin. The simplest method,

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used for the Glasspar body, is the lay-up. Tailored glass-fiber pieces are put on a female mold that has been slicked with a fast-curing coat of plastic to assure a smooth outer surface. Plastic is squeegeed into the glass cloth and allowed to harden.

The lay-up method is especially suited for large objects and comparatively small output. Frequently, however, some form of low-pressure molding is used to make the material more compact. The fiber and resin may be pushed against a female mold by an inflated rubber bag, or sucked against a male mold by vacuum. For high output, matched male and female molds, heated to cure at the same time, are widely used.

Stronger Than Steel

Reinforced plastic has a lot to offer. Weight for weight it can be made stronger than steel. Brilliant colors can be added in the resin. The plastic can be made as resilient or resistant as you desire. It makes much lighter auto bodies, which in turn make possible lighter engines. Sound and heat insulation—and therefore comfort—are improved. Construction is simplified.

Ford's pioneer plastic car had a welded structure of steel tubes, serving both as chassis and body frame, that was covered with plastic panels. William B. Stout, noted aircraft and auto designer, later developed a Fiberglas car with no frame at all. Even its bumpers were plastic. It was 1,000 pounds lighter than a conventional body, but Stout added ruefully that it was too expensive to be produced at that time.

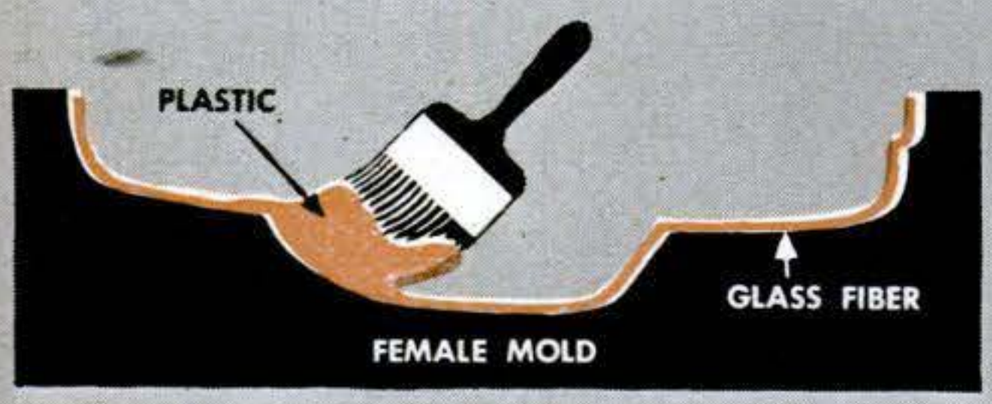
Chrysler, too, has spent much time and money on the plastic-body dream. Fenders, doors, rear-deck lids, hoods, instrument panels and removable convertible tops were fabricated of polyester plastic and glass fiber as long ago as 1942-43.

With all this research behind them, the auto men recognize the advantages of the plastic body. But, they say, it cannot now be made for a mass market. Here are the reasons they give.

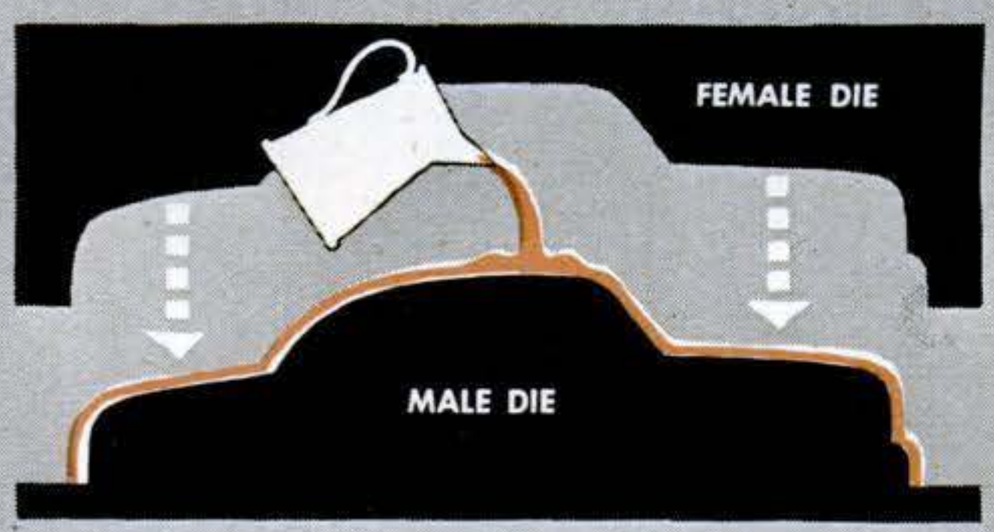
Basic is the cost of the material itself. Steel sells for less than a nickel a pound. The price of reinforced plastics varies from around 50 cents a pound when mat is used to as much as $1.75 a pound with a glass cloth. This is partially offset by the smaller weight of plastic required. For small runs,

[Continued on page 240]

How Plastic Bodies Are Formed

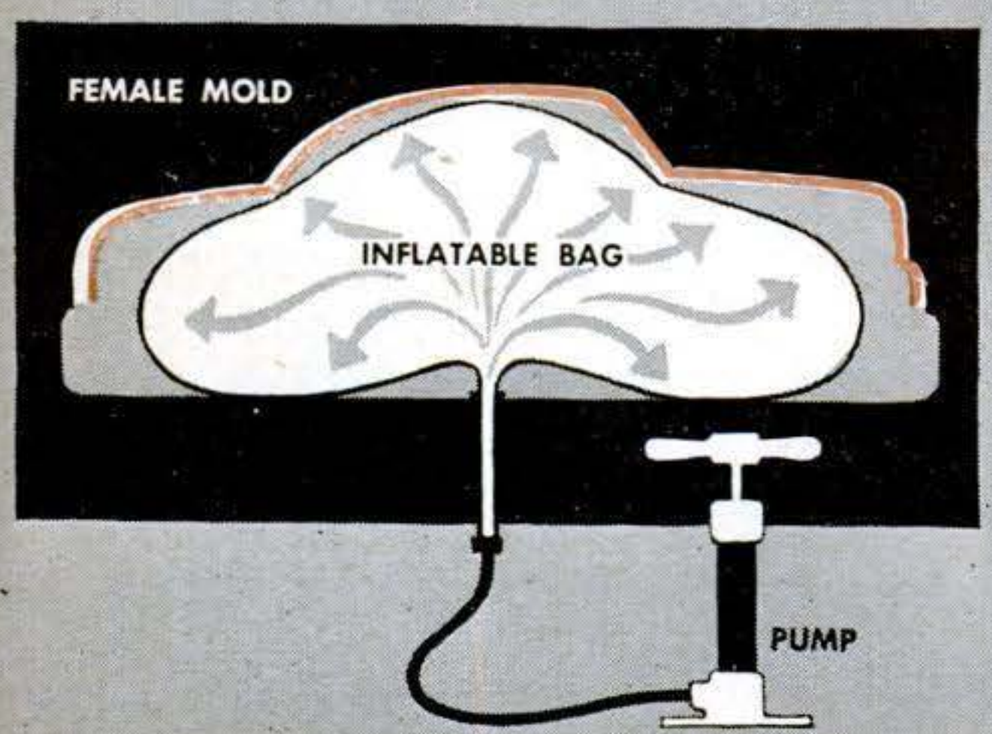


1 LAY-UP, simplest method, uses either male or female mold, needs no press. Glass-fiber pieces are laid on mold and plastic is brushed in until desired thickness is reached.

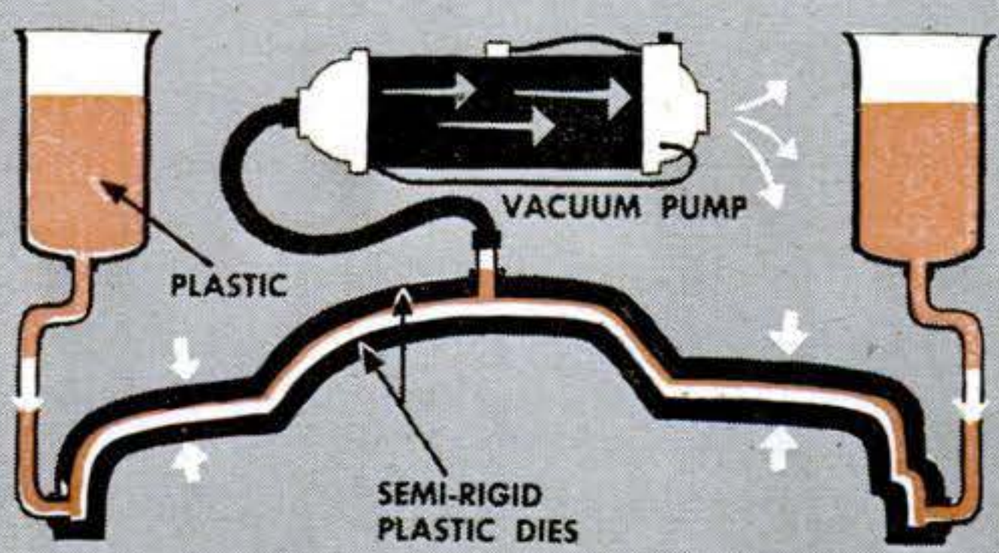


2 HEATED MALE AND FEMALE DIES are the most expensive to use but quickest, and therefore are best suited for mass production. Mold pressures are 100 to 250 pounds.

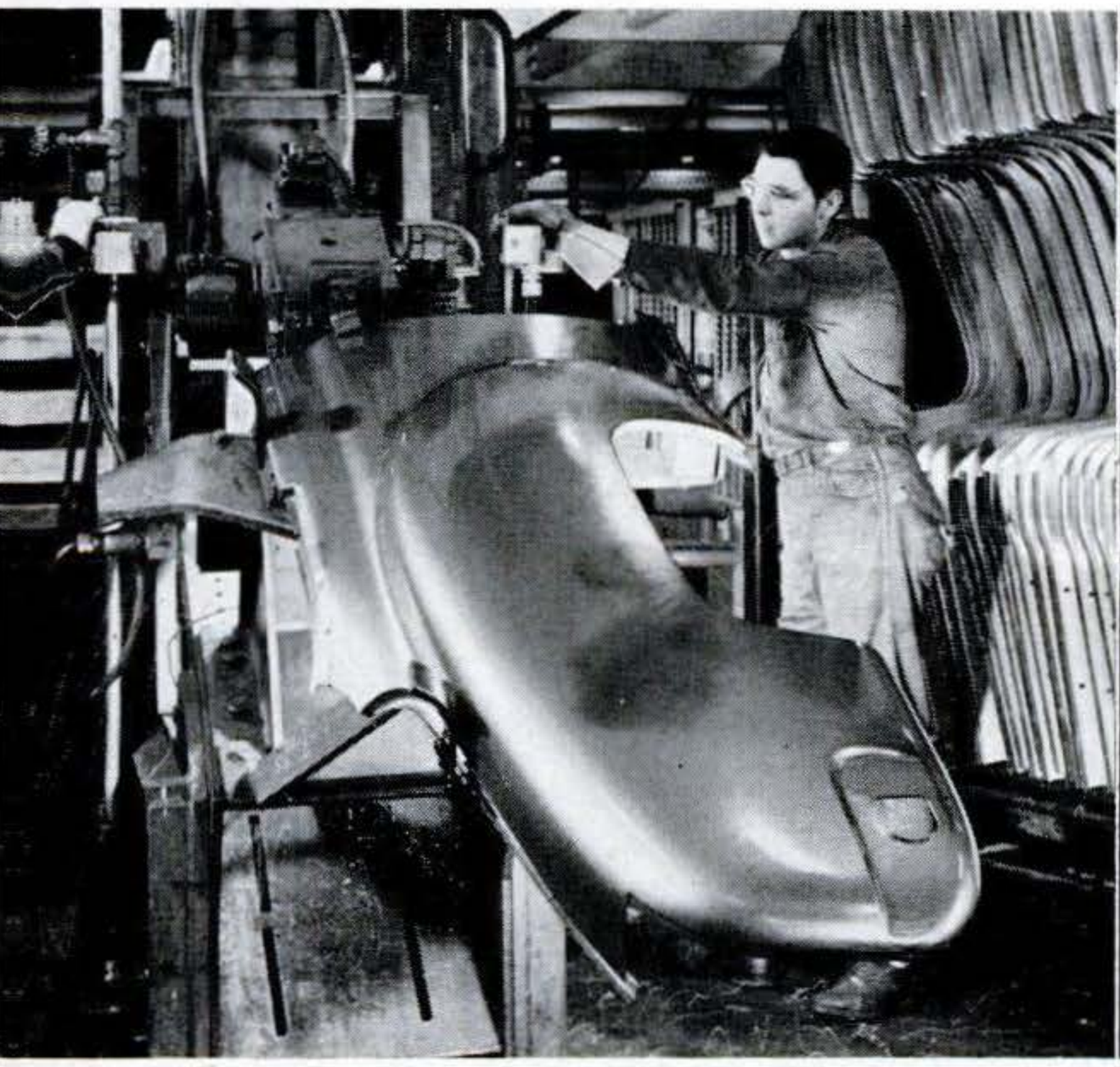
3 BAG MOLDING is used for large, irregular shapes. An inflated bag pushes glass and plastic against a female mold at pressures between five and 30 pounds per square inch.



4 IN VACUUM MOLDING, semi-rigid plastic dies are pulled together by exhaustion of air in space between. Same vacuum sucks in plastic through the fibers around rim.



HENRY FORD SWATTED his plastic car with an ax in 1941 demonstration of ability of experimental body to withstand impact. It had plastic panels mounted on a tubular frame.



ASSEMBLY-LINE METHODS of producing steel bodies are shown at this Fisher Body stamping plant at Pittsburgh. Note stack of rear fenders beyond resistance-welding machine.

GLASSPAR BODY is made by lay-up plastics method. Men are placing glass cloth over glass mat in female mold and coating with Vibrin resin. Glass must be tailored to fit.

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P.S.

Last minute news & notes...

A NIGHT-FLYING BOMBER that could make "a flight around the world under cover of darkness--beating the clock--and on a pound of fuel with plenty to spare" may result from current development of atomic-powered planes, says the Aircraft Industries Association . . . LAUNCHING an F-84 Jet fighter from a huge B-36 in flight, a recent Air Force feat, foreshadows bombers carrying their own escort for defense against enemy aircraft.

SMELTING IS ELIMINATED by a revolutionary chemical way to get copper, nickel and cobalt metals directly from ore. In an autoclave, or "pressure cooker," hydrogen gas and other reducing agents precipitate the metal from acid or ammonia solutions. Product: a metal powder more than 99.9-percent pure. First big plant to apply the idea, developed by American Cyanamid Co., will go into operation this summer.

A NEW KIND of stop-go signal automatically flags down a motorist going too fast for his own safety at a curve near Natural Bridge, Va. His car wheels pass over a detector in the pavement that sets the signal according to his speed. At 25 miles an hour or less, he gets a green light. If he is going faster, a red light makes him stop and wait for it to change. Twelve deaths at the curve inspired the safety signal.

SAWDUST fuels a gas turbine developed at the Oregon Forest Products Laboratory. An experimental model adapted from an aircraft turbosupercharger has been successfully operated there.

NEWLY PLASTERED WALLS should be left undecorated for at least a week--with some brands of plaster, for a whole year. MIT researchers say this time is needed for slaked lime in the plaster to combine with carbon dioxide in the air to form calcium carbonate. The slaked lime may bleach paint or wallpaper; the carbonate is harmless.

THE TWELFTH U. S. CAR to adopt overdrive is the Plymouth. This fourth-speed device will be optional on its '52 models. Its inventor, William B. Barnes, estimates that at least 4,000,000 overdrives are on the road today . . . HORSEPOWER KITS for boosting the output of 1949-51 Cadillacs are now available from the factory. They consist of parts made for the 190-horsepower 1952 engine . . . PINK TIRES? Maybe. There's a new synthetic called Hypalon that is suitable for auto tires and can be compounded with colored "fillers" instead of carbon black.

A NEW HEAT GAUGE will warn a truck driver if differential oil gets too hot. Made by Stewart-Warner, it's a heat-sensitive element screwed into the rear-end housing and wired to a dial on the dash.

CURRENT COMMENT

"EXCEPT FOR ACTS of imagination or genius, there is scarcely any human mental occupation which, in principle, an information machine could not do better or faster."--Prof. Louis N. Ridenour, University of Illinois . . . "INVENTION IS ONE of the greatest arts. In its broadest sense it embraces all of the arts. It is the bringing together of known elements into new relationships." --Thomas J. Watson, chairman, International Business Machines.

WEEDLESS GRASS, whose strong turf rarely if ever needs watering, will be introduced soon. It should prove ideal for home lawns, as well as for golf links, for which it is under cultivation by the U.S. Golf Association. The seed is a blend of Meyer Zoysia, an Oriental variety said to be so tough that it pushes crab grass out of the way, and of heat-resisting Merion blue from an Ardmore, Pa., golf club.

The Editors

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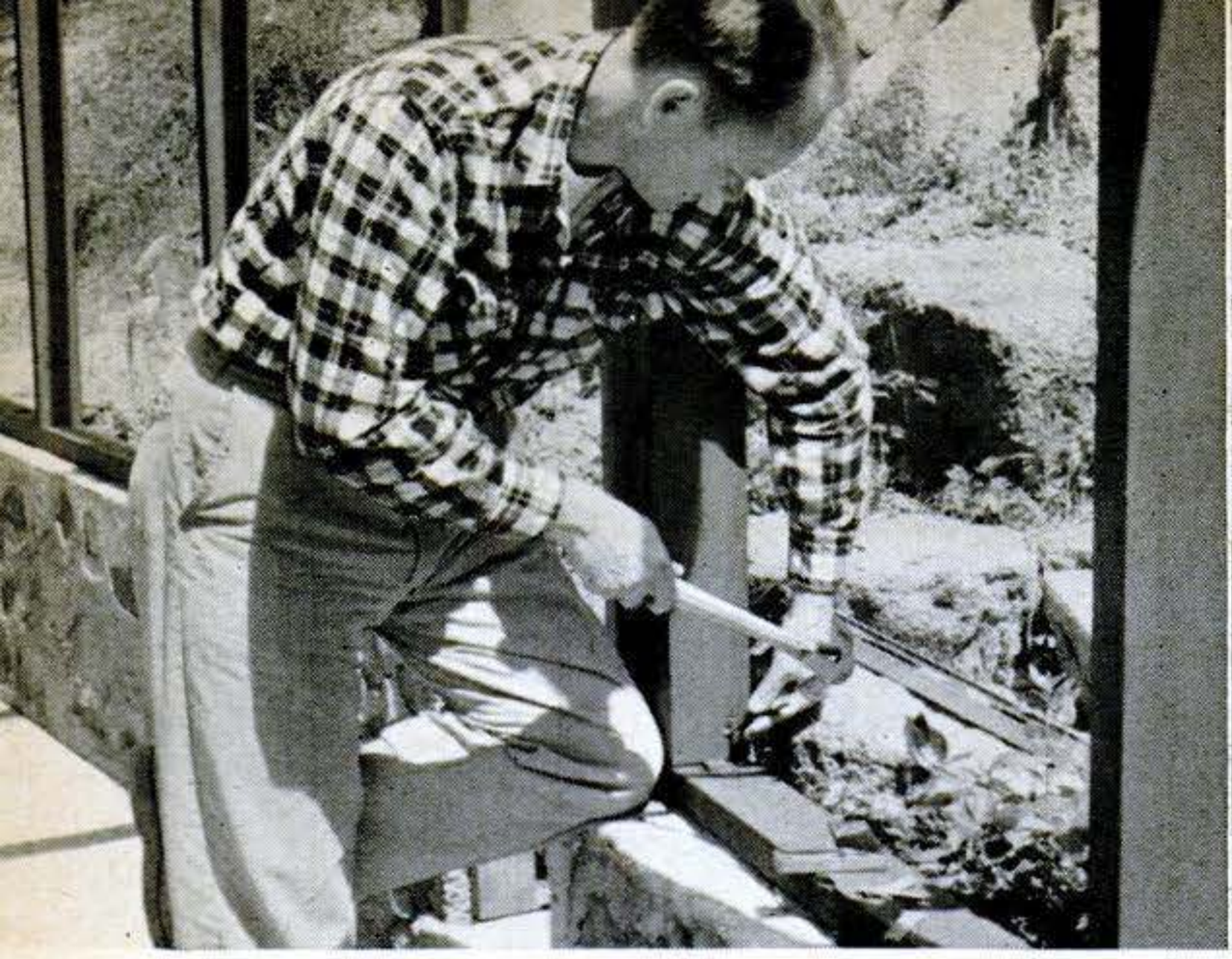
MECHANI
and
HANDICRA
REG. U. . PAT. OFF.

These colorful plastic panels go on with hand tools. Here are seven pages of ways to use them.

New Porch Roofing Lets in Light



1 LOW STONE WALL is base of my covered terrace. Two-by-four sill was bolted to top of wall. Porch framing could begin at ground level with sill on slab. Studs are 3′ apart.

2 ALL FRAMING is two-by-fours for economy. Rafters are nailed to face board and both are nailed to studs. Two rows of spacers 4′ apart are toenailed between rafters.

By Darrell Huff

"I WANT a screened porch at the back of the house," my wife said, "but I do *not* want the rooms there made dark."

That put the job up to me. Because how are you going to roof a terrace without darkening the windows that look out on it?

I found an answer, though. It was the translucent-plastic building material that you saw in the cantilevered roof of the porch shown on the preceding page. This material comes in both soft and brilliant colors. Roofing a porch is just one of its uses.

A sheet set in a frame makes a door that is a slick answer to dark doorways. It can be used for skylights, translucent windows, sun shelters, interior partitions, louvers, awnings, bathtub and shower enclosures, fences, diffusers for light fixtures. Even the manufacturers are being surprised by uses to which buyers are putting it.

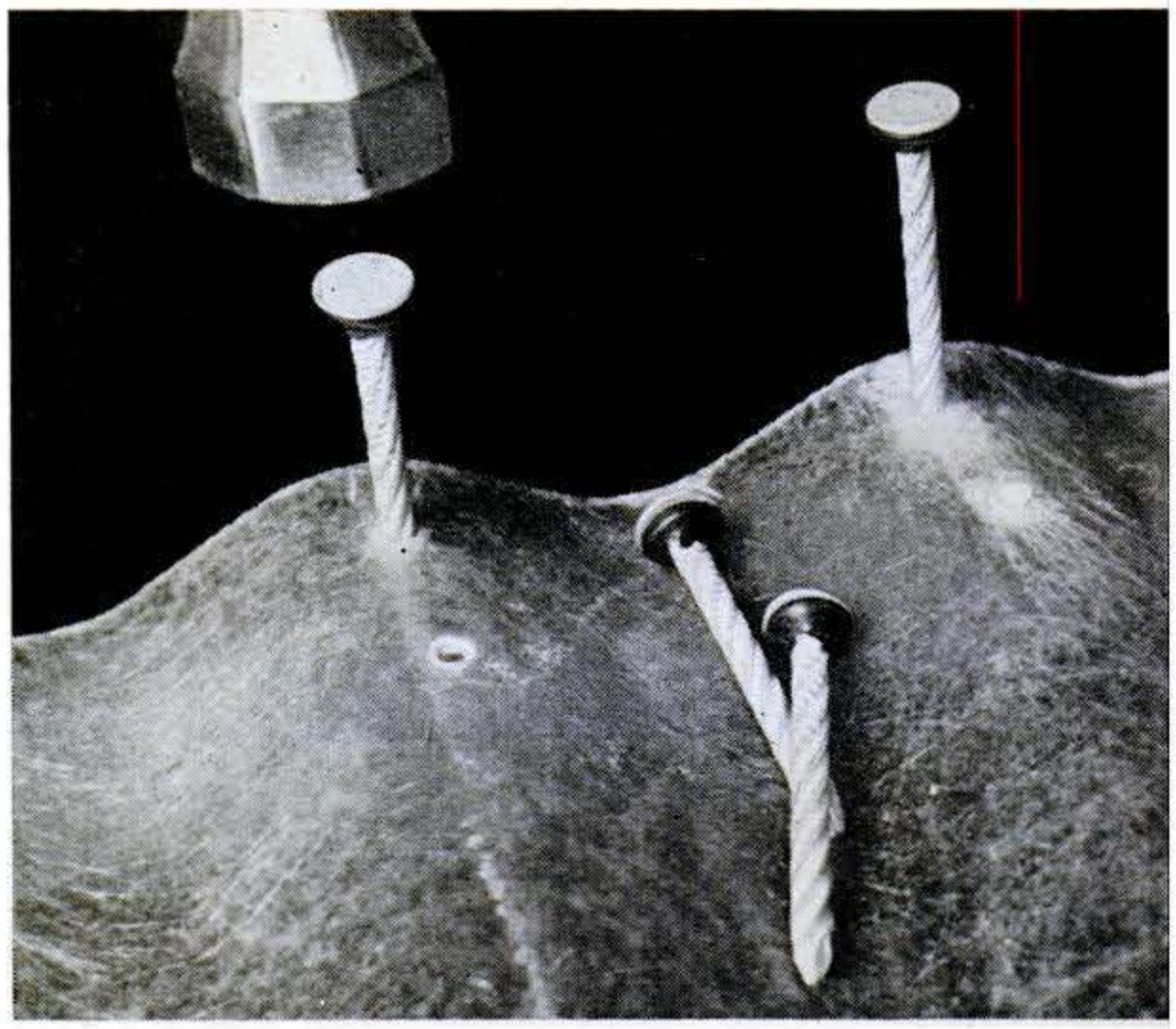
I used a dark shade, leaf green, to roof my terrace. It not only looks cool but actually is, since it cuts out the greater part of the heat rays while letting through a good deal of light.

More Light Instead of Less

One odd thing has happened, something I didn't expect and that even the manufacturer hadn't promised. Instead of making my house darker inside, the porch has made it much lighter. It appears that the whole terrace roof is now taking up light as a sponge takes up water and shooting it in through my windows.

Made by impregnating a glass-fiber mat with polyester resins, this material has a number of interesting characteristics. It is quite amazingly strong and light (half a pound to the square foot), impervious to all kinds of weather and resistant to fire.

5 PREDRILLED HOLES (left below) are best; nails driven without drilling produce local crazing marks (right). Aluminum screw-nails won't rust, come with neoprene washers.



With retail prices around $1.35 a square foot, it is not cheap. In use, however, it is more economical than this sounds, since it needs only light framing, goes up fast, can be cut and placed with ordinary tools, and is easily handled by one man.

The neatest and quickest way to cut it is with a cutoff wheel in a power saw. Any fine-tooth handsaw will cut it, but—as I

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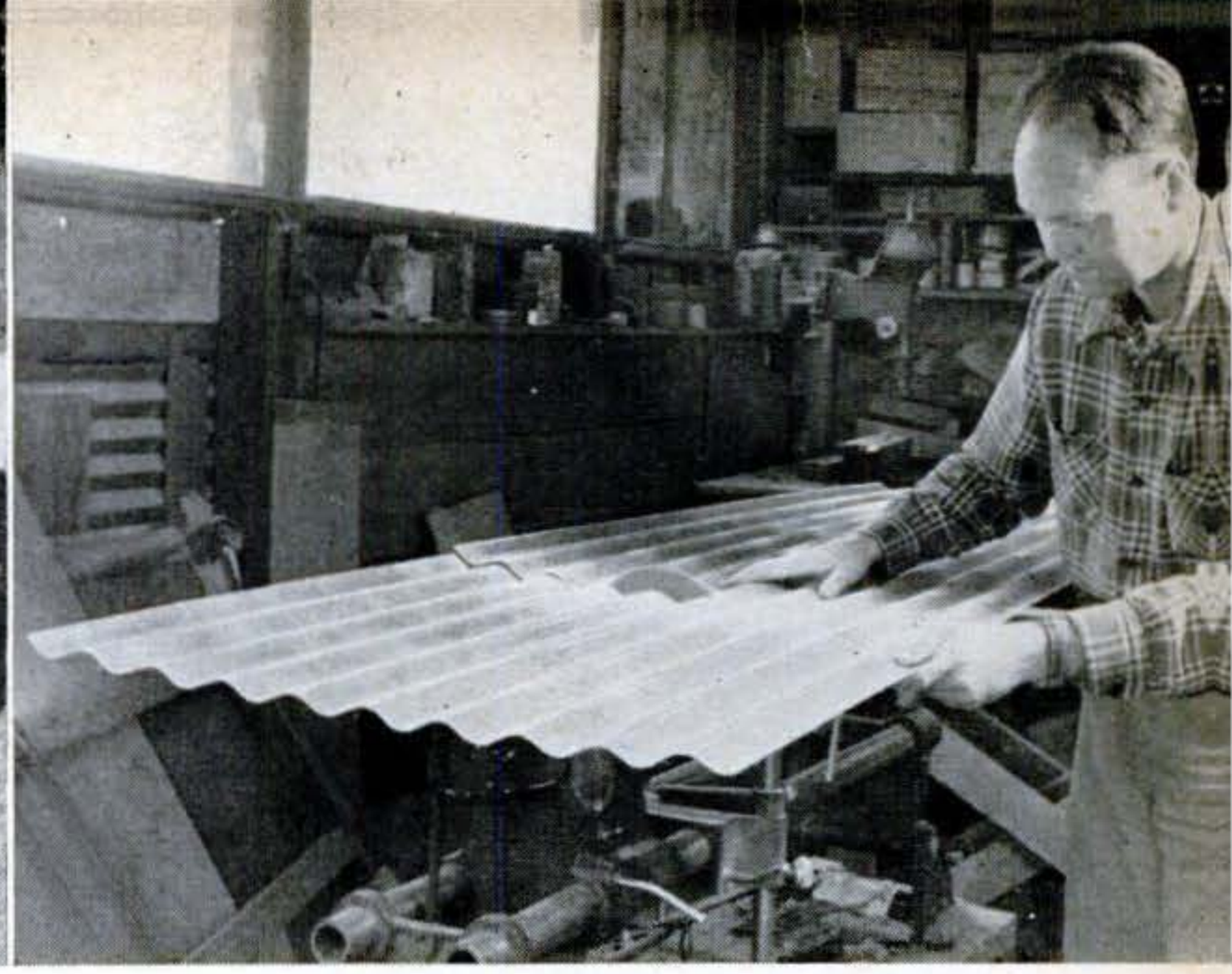

3 **HANDSAW** will cut the plastic panels. Use an old saw because plastic dulls the teeth quickly. Fairly fine-tooth blade is best. Use grease pencil or crayon to mark plastic.

4 **ABRASIVE CUTOFF WHEEL**—same kind used to cut metal—does nicely with plastic panels. Use it on table saw or portable saw. Carbon-steel blade cuts well but dulls fast.

6 **NAILING** can be done while you kneel on top of the plastic panels, which are strong enough to hold several persons at once. Photo below also shows how corrugations of two sheets are lapped. Increased overlap and mastic would make completely waterproof joint. I used one nail through every second corrugation on edge, every third elsewhere.

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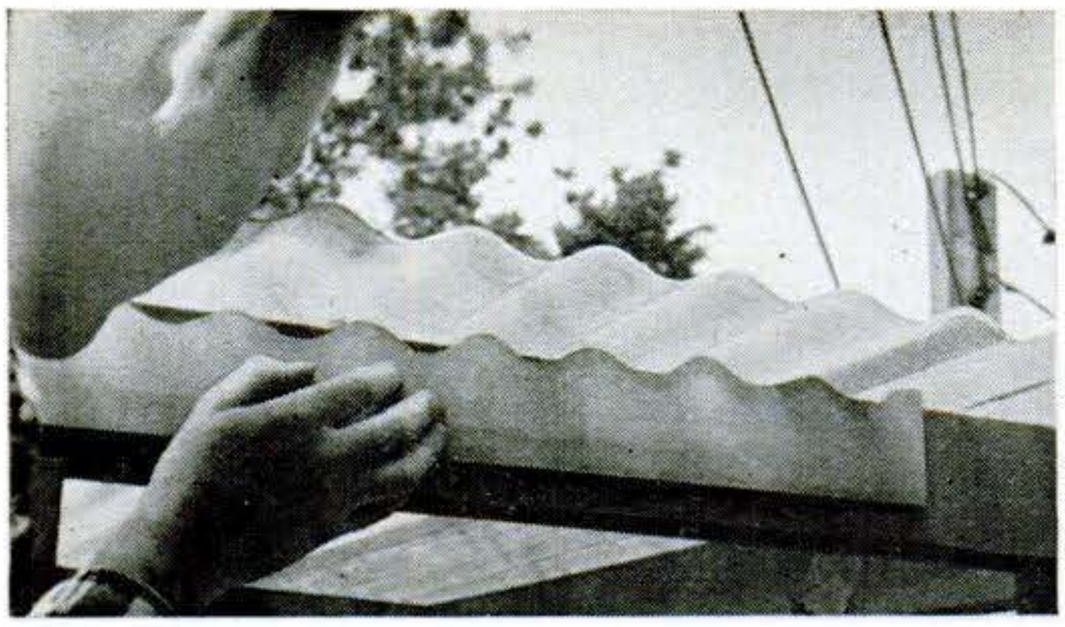

7 SCALLOPED EDGE of ½″ wood closes openings between top of face board and corrugations. Since this porch is to be screened in later, it was important to plug all gaps.

found out—the teeth will dull rapidly. It has also been cut successfully with a portable power saw and ordinary blade. You can make small trimming cuts with big shears or tin snips or a small metal-cutting handsaw. Cutting is not much of a problem with most home installations, where you can simply buy sheets the right size and put them up as they come.

Fastening may be done with bolts or screws, but nails usually are used. Aluminum screw-nails with neoprene washers, sold for corrugated aluminum roofing, worked out fine for me.

8 FINISHED PORCH is cool but bright as sunlight is diffused by the plastic panels, and the eye-resting color makes the area seem even cooler than it is. The rooms with windows opening onto the porch are brighter than they were before because the plastic roof catches the sunlight and acts like a big lighting fixture to spread the illumination.

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Holes for bolts or screws may be made with any hand or power drill. Drilling holes for nails makes for greater neatness but isn't necessary on most jobs.

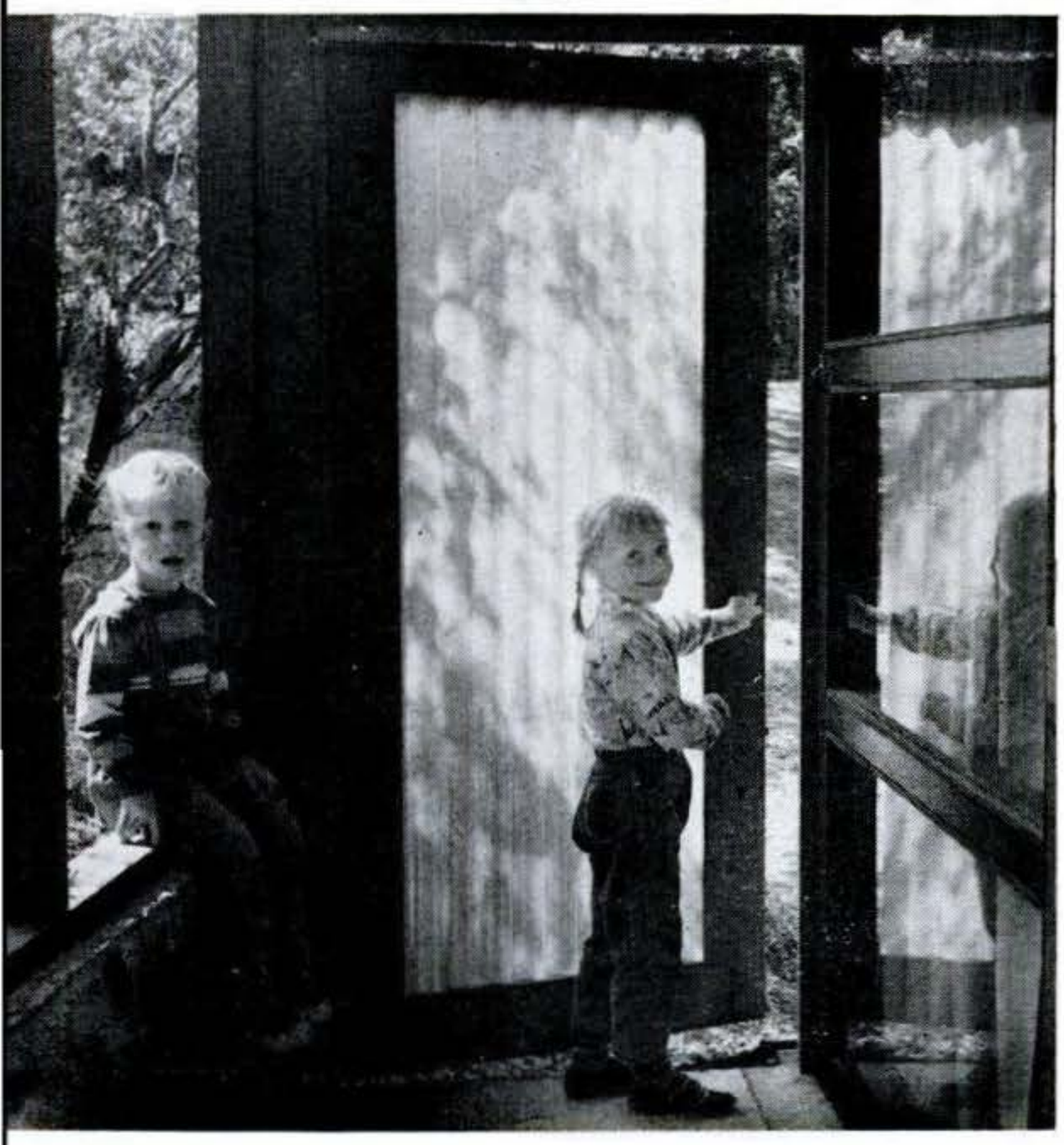
Overlapping Makes Tight Joints

You can get the plastic sheets with corrugations to match various aluminum and asbestos-cement roofing materials. They come in several widths and in 8′, 10′, and 12′ lengths. There are curved sheets and flat sheets.

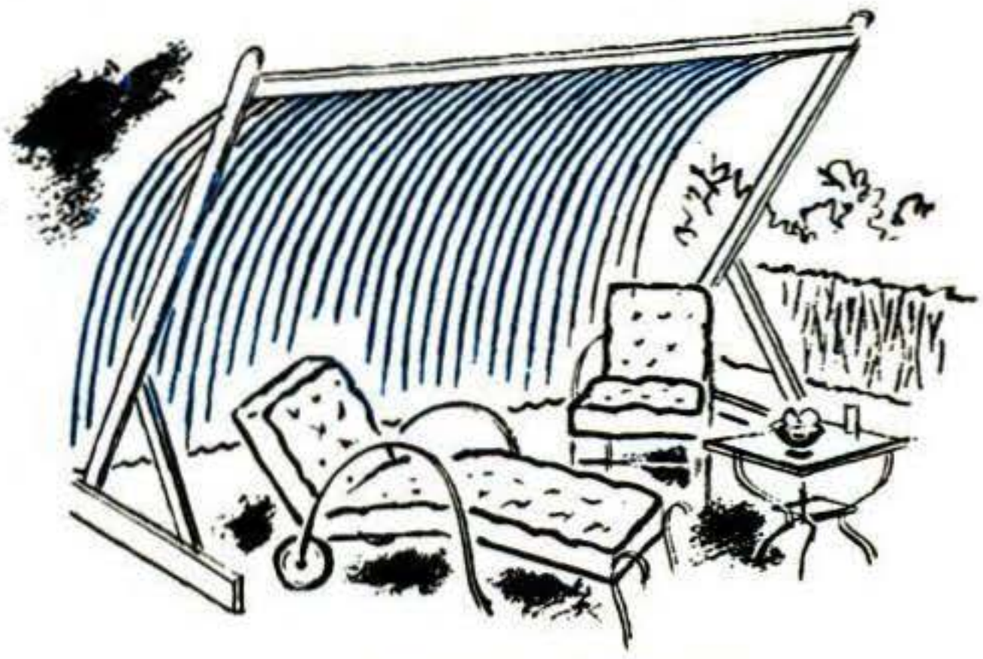
In joining sheets you may lap them one or 1½ corrugations. Mastic is available for

9 DOOR is plastic framed with two-by-sixes at sides and bottom, two-by-four at top. Inside of stiles was grooved ⅛″ by 1″ at 30° angle, the angle where corrugation was cut.

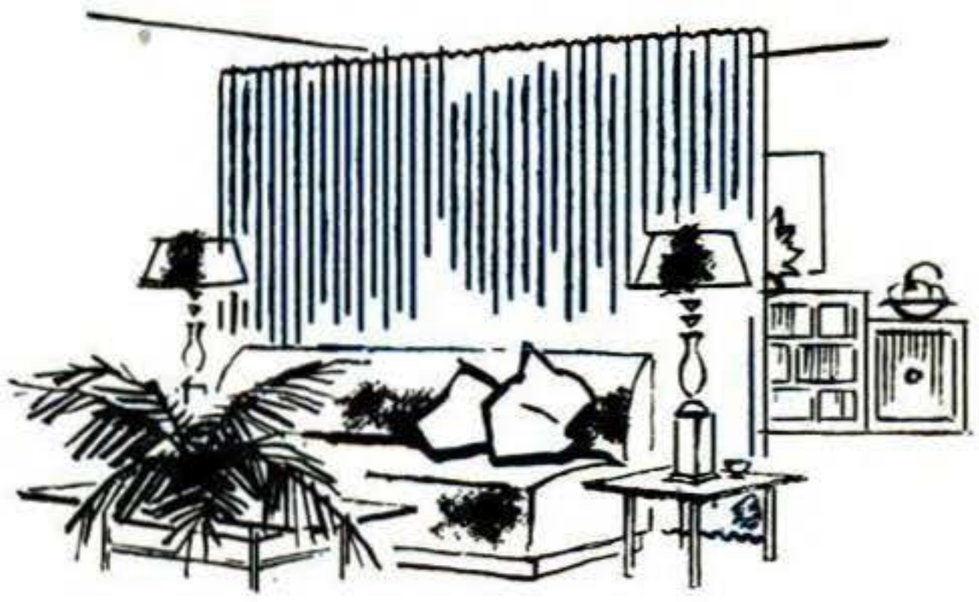
10 HINGED AND HUNG, finished door lets in light but blocks view into porch from road. Molding on inside edges of top and bottom rails was jigsawed to fit corrugations.



More uses for plastic panels are shown here and on the next page

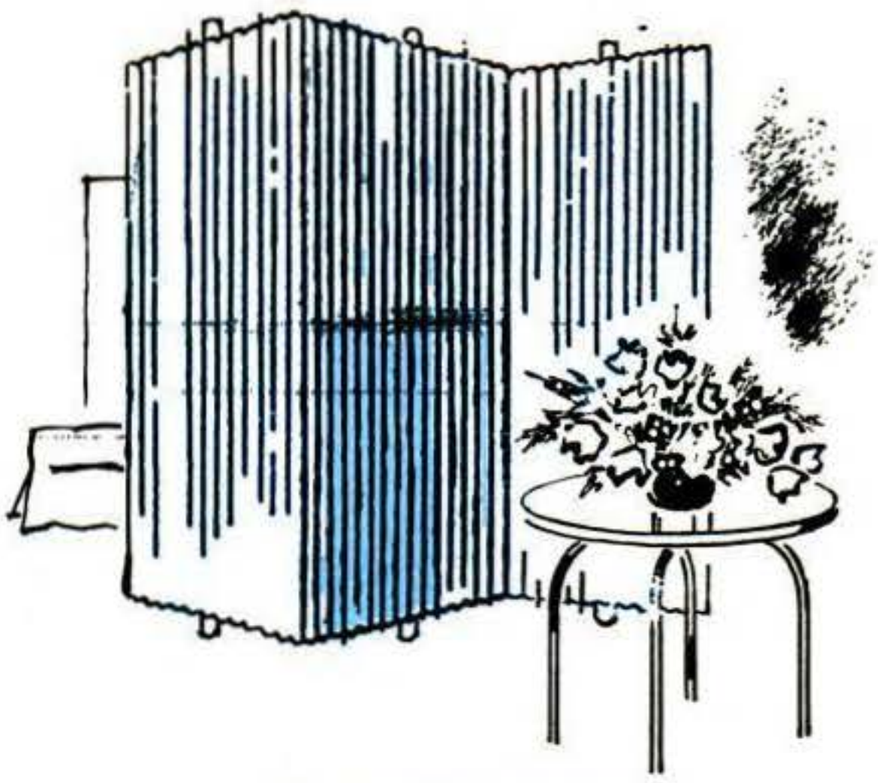


GARDEN SHELTER



INTERIOR PARTITION

AWNINGS AND SKYLIGHTS



FOLDING SCREEN

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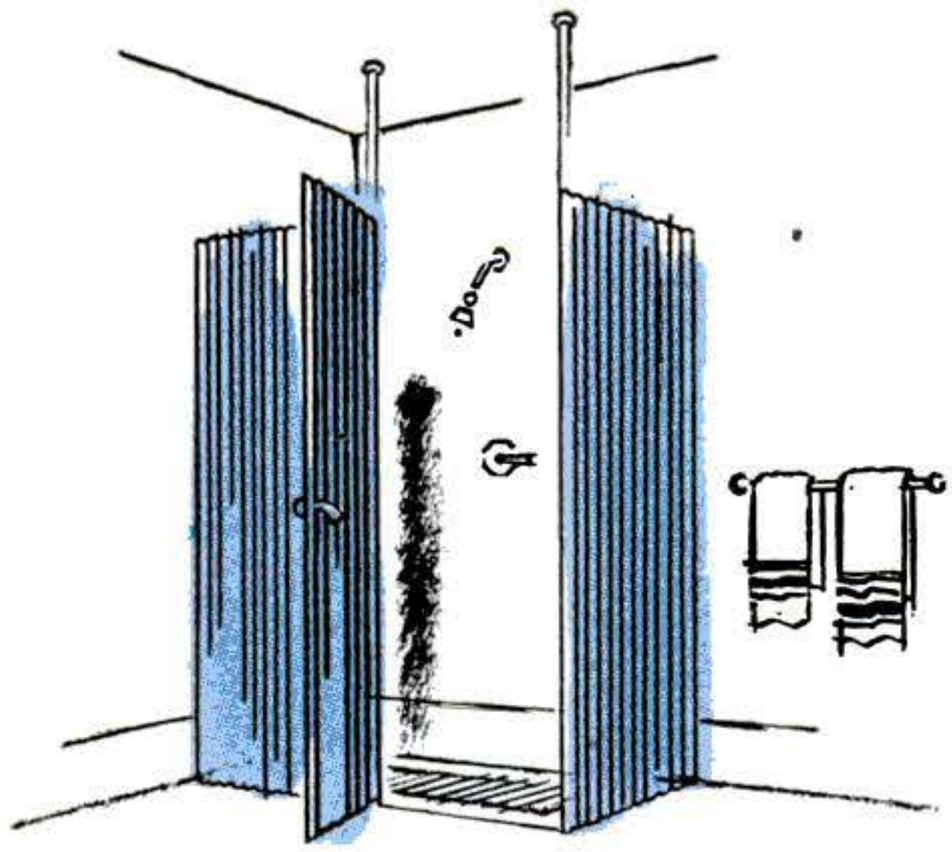
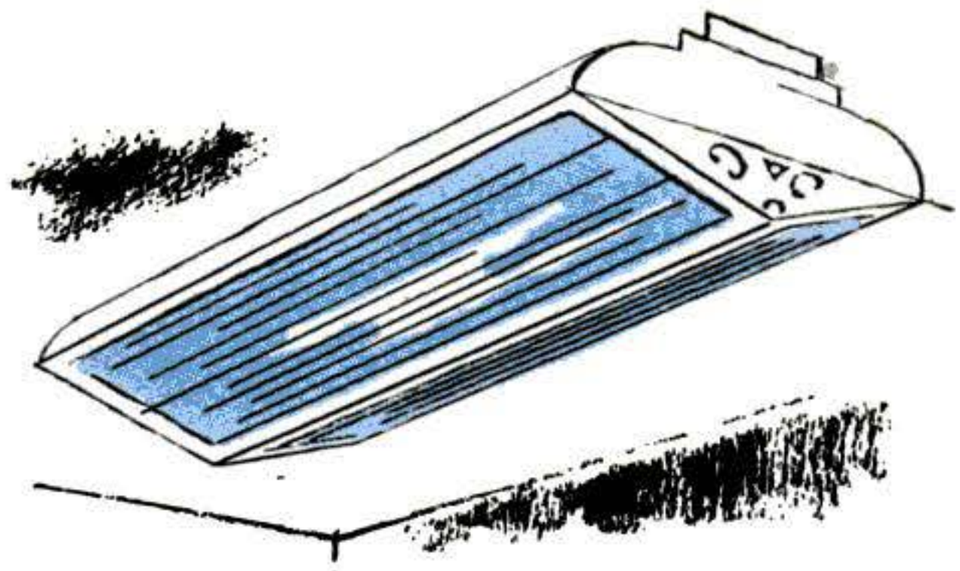
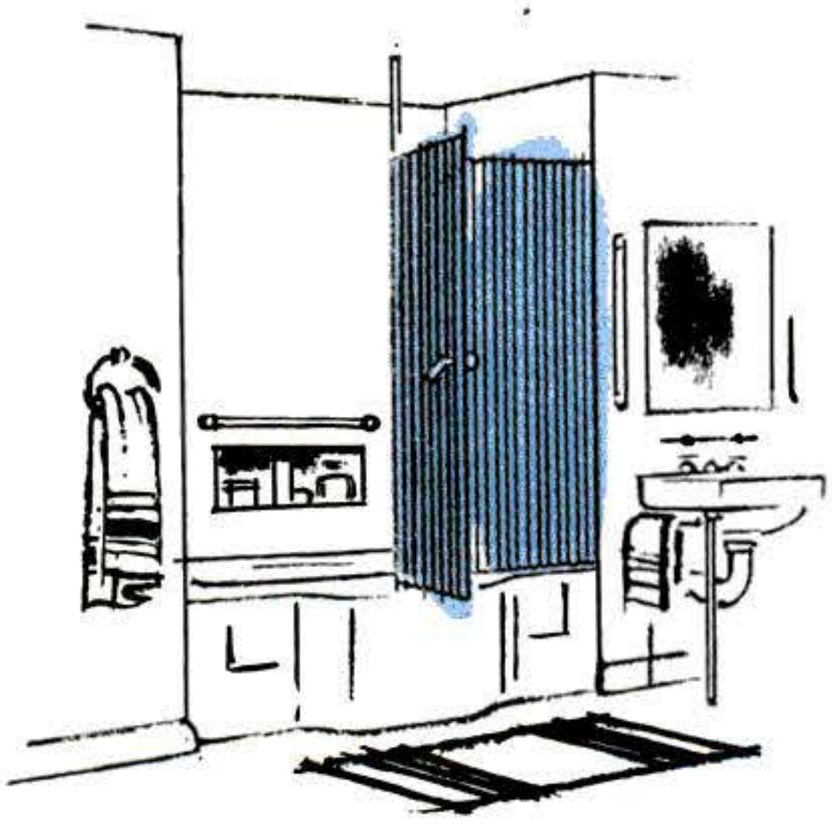


STALL SHOWER



FLUORESCENT DIFFUSER

CARPORT



ENCLOSED BATHTUB

cementing sheets together where, as in a skylight, tightness is essential. Also use the mastic on a flat roof, and remember to allow a slight pitch for good run-off of water. It's best to run the corrugations in the direction of the slope, and overlap the higher strips over the lower ones so rain and snow can't collect.

End laps should be 6″ to 8″, depending upon pitch of roof. Since these materials are made in sheets up to 12′ long, end laps are often not necessary.

Simple Frame Supports Roof

Various accessories—corrugated moldings and closures—can be obtained for fancy jobs, but they are not required for most home projects.

To frame up a roof for Alsynite[1] or Corrulux[2]—the two brands of plastic sheet that are popular in my neighborhood—you can use the pattern shown in the photos. Or follow these standard specifications for a roof that will do nicely for a great many purposes:

- Make rafters of two-by-sixes on 22″ centers.
- Put two-by-four purlins (crosspieces) between them, flush with the tops of the rafters and not more than 4′ apart.
- If you want to paint or stain the lumber, do it before you put on the plastic.
- Use 26″-wide sheets with 2⅝″ corrugations (their width from hump to hump). This width will make each lap come at a rafter for strength.
- Nail with aluminum nails having neoprene washers. Nail on every second or third corrugation on the purlins and at 18″ intervals along the rafters.

Different Colors Create Many Effects

That's all there is to it—except for choosing your color. If you want to let through most of the heat and light of the sun and get a cheery, sunshiny effect, use a yellow shade.

Green shades will give you the coolest effect, both psychologically and actually, and still let more than half the light come through.

For equal coolness, use aquamarine if you want to reduce the light to about one-third. This is the most popular color for porches exposed to too much sun.

Rose will cut down on light more than it

1. *Alsynite Co. of America, 4670 DeSoto St., San Diego 9, Calif.*
2. *Corrulux Corp., Box 20026, Houston, Tex.*

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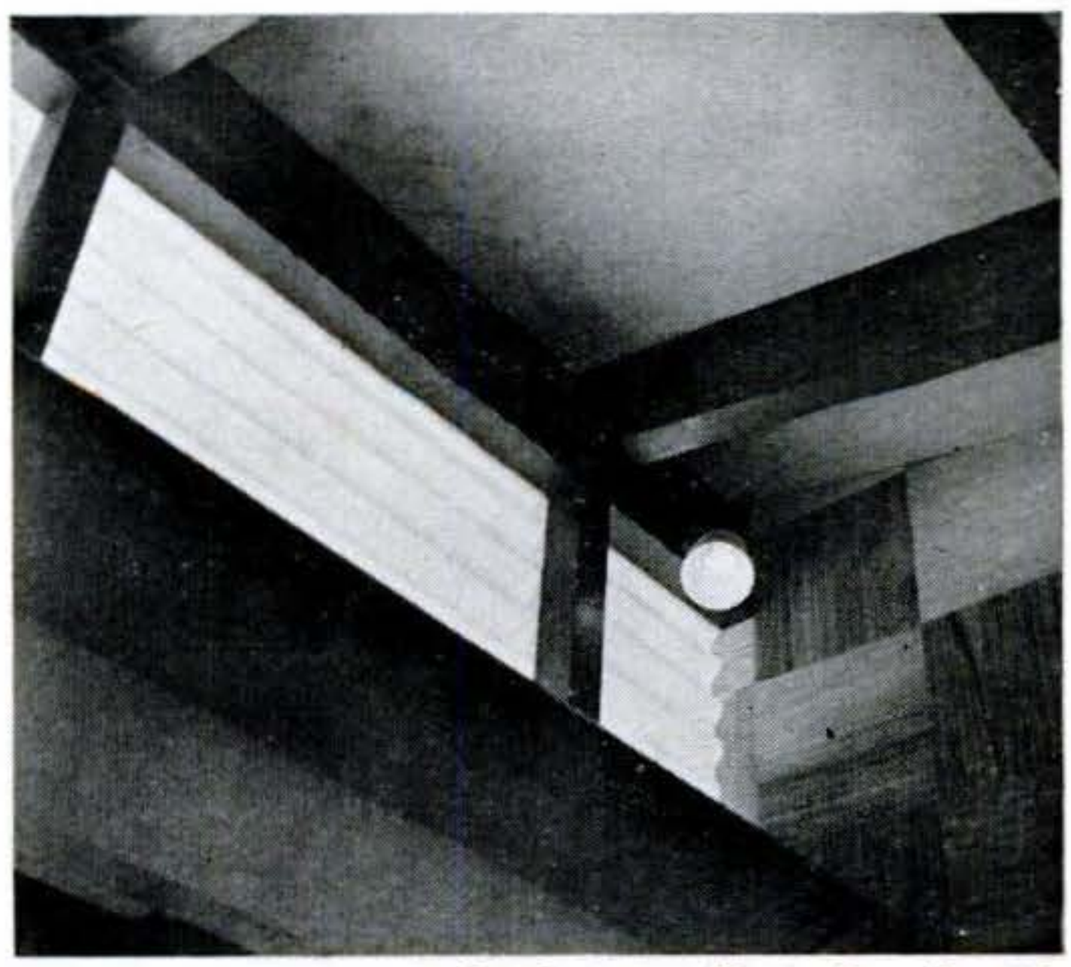
TRANSLUCENT-PLASTIC ROOF over entryway can be pushed up for ventilation in hot weather. In cool weather, frame holding the plastic panels fits down tightly in rubber gaskets.

will on heat. Use it for the flattering light it gives and for places where the sun's heat is often welcome.

All this applies mostly to outdoor uses, of course. When plastic panels go to work as room partitions, shower enclosures and light-fixture diffusers, color becomes a matter of appearance only. You will be guided largely by what colors are already being used in the room in question.

One caution, though: be prudent about using blue or green on light fixtures, especially in living and dining rooms. Both food and complexions can look a bit weird under light of these colors. Rose, on the other hand, is both cheering and flattering to any complexion. At least one great party-giver has attributed much of her success to rose-colored lighting: it made the women so much more attractive. END



NARROW OPENING, high in wall, is fitted with plastic panel to light what otherwise would be the dark side of a room. Corrugations in this application run parallel with ceiling.

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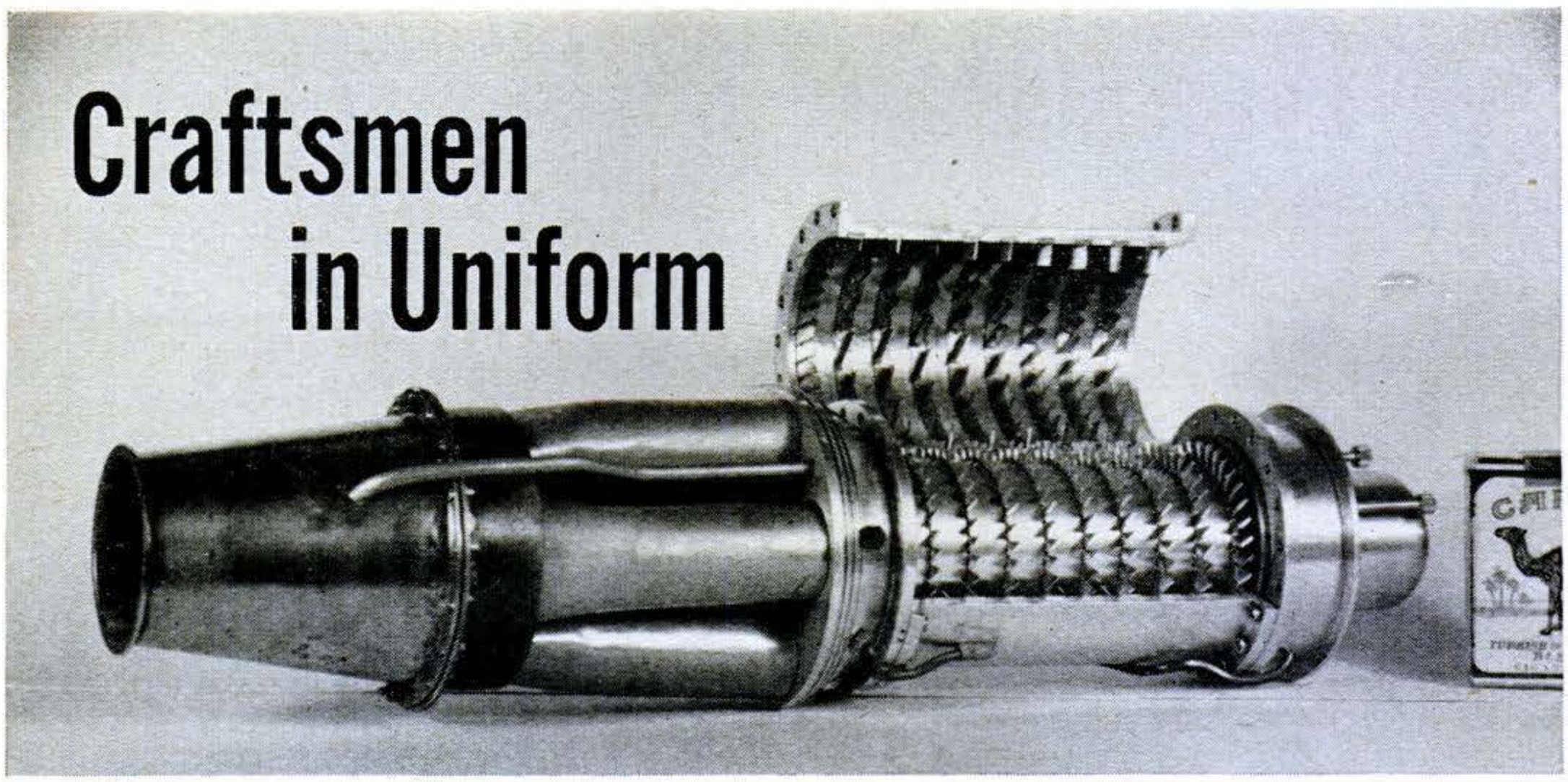
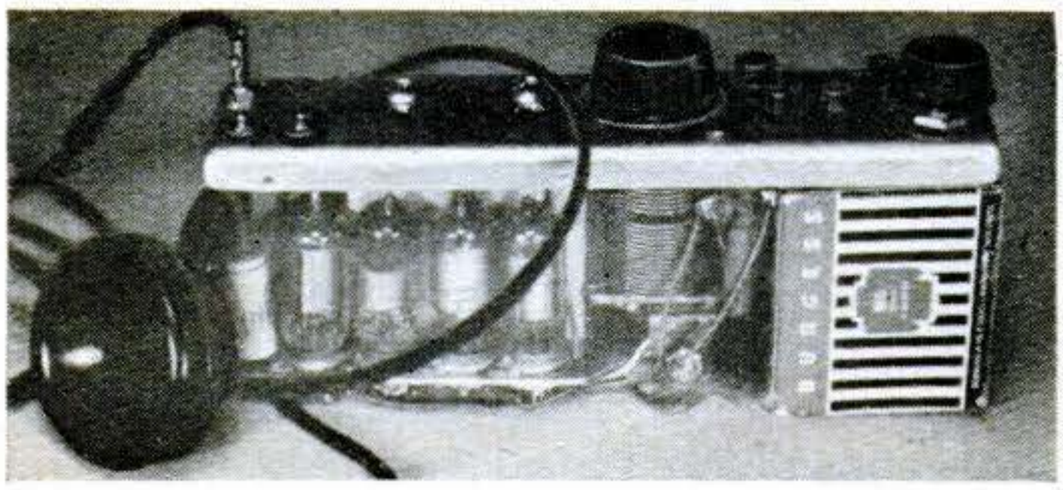
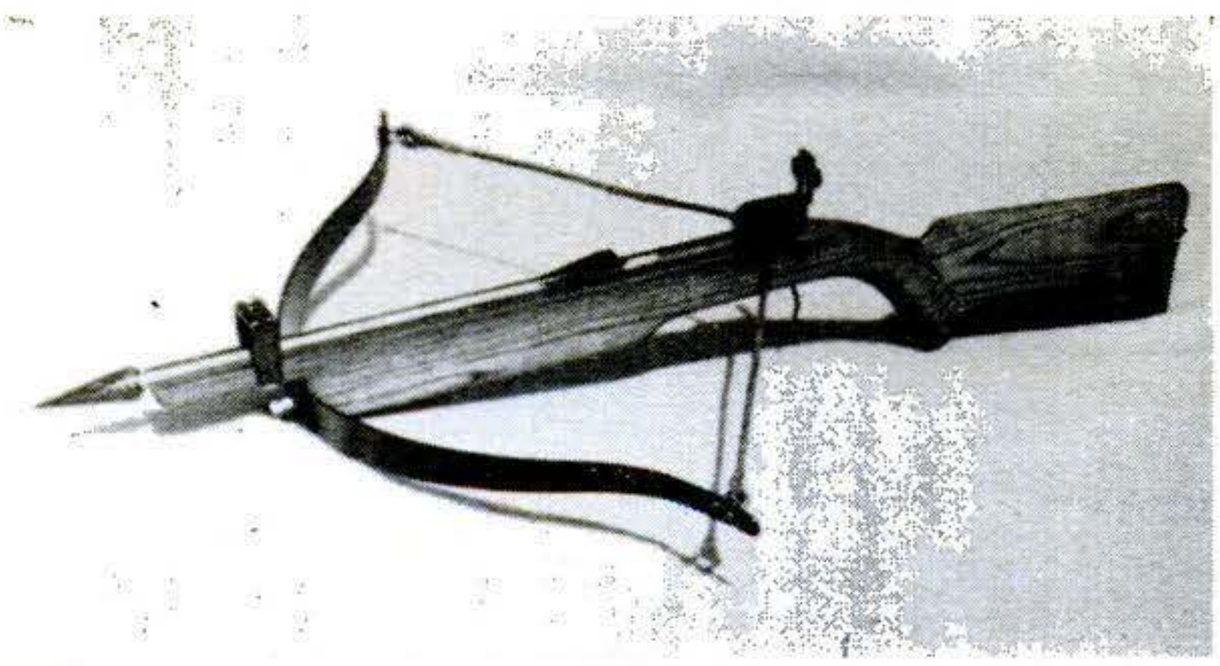
Craftsmen in Uniform



Tiny Turbojet. This baby jet engine, similar to the Allison J-35 series in design, has a nine-stage axial-flow compressor and five combustion chambers with interliners. The compressor is made of aluminum; the turbine wheel, vitalium; and the combustion chamber, stainless steel. Everything but the main bearings was scrap, according to Capt. Leslie F. Walters of Hamilton Air Force Base, Calif. He designed the jet primarily as a training aid, but he has revved it up to 25,000 r.p.m. with compressed air. Now he's working on a fuel and lube pump that will fit in the nose-section housing.



Motorcycle Radio. This four-tube superhet, super-compact to ride a motorcycle, is built to fit in a welded waterproof case. B current is supplied by battery; filament current by one cell of the motorcycle battery. The maker, Capt. Philip H. Poser Jr., Wright-Patterson Air Force Base, Ohio, uses a crystal headset while riding, but can switch to a speaker.



William Tell's M1. This crossbow gets its punch from modern technology —the 125-lb. bow is a 31″ automobile spring leaf. It has adjustable sights and a special trigger, reports the maker, First Class Machinery Repairman William C. Meyers of the USS *Sphinx*. The 35″ stock is white ash, oak-finished; the bow string is 32 strands of waxed flax. Meyers makes his arrows from birch dowels.

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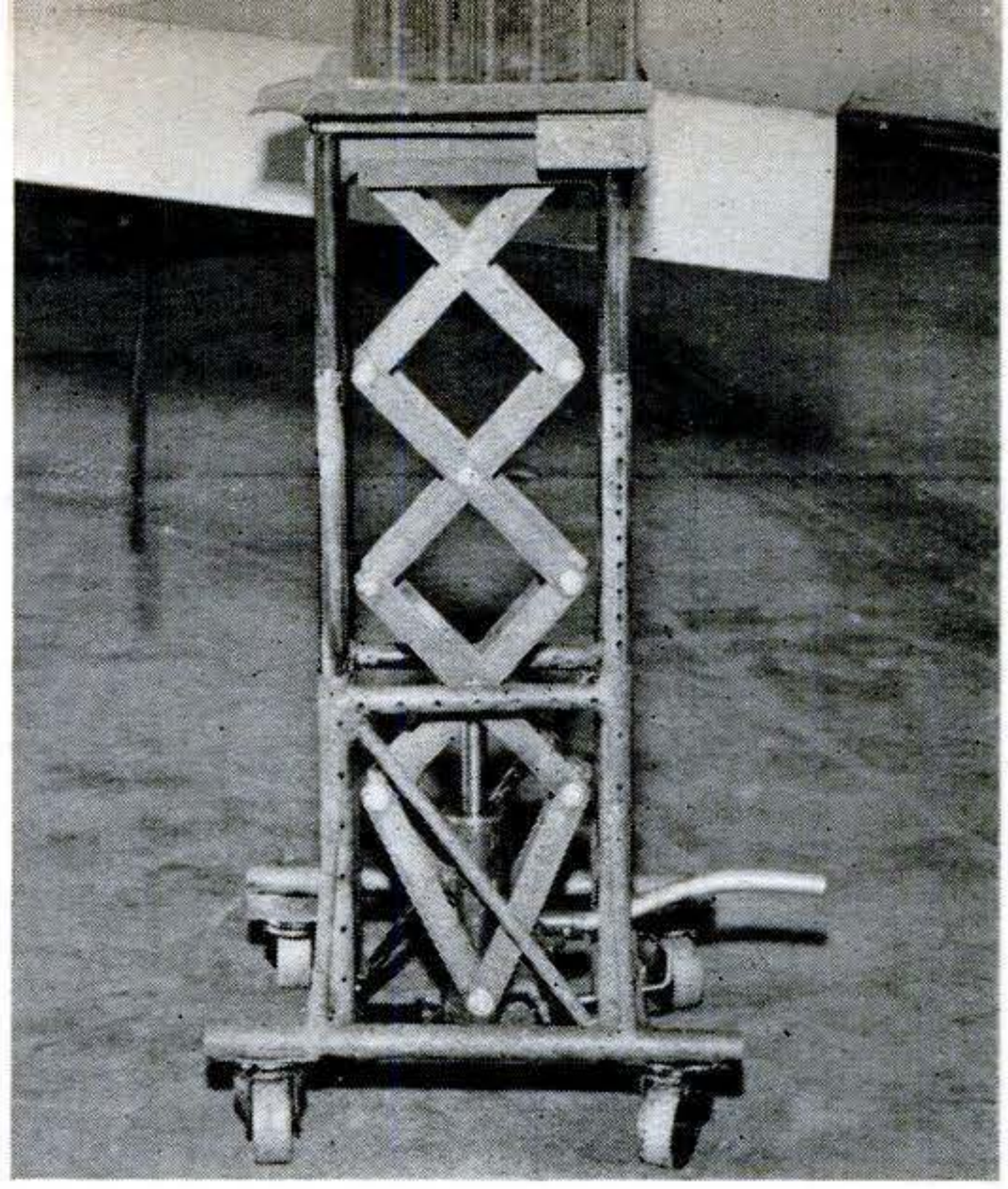
Beep-Beep, the Baby Jeep. Lined up beside a regular jeep (above) this Beep makes the jeep look like a prime mover. Measuring 6′ long and 3′ wide, the Beep carries two passengers, has a rear-mounted 2¾-hp. Wisconsin air-cooled engine (below). A scooter chain with an automatic clutch drives one rear wheel. The steering-post shift lever controls two forward speeds and reverse. Both rear-wheel brakes are from a scooter. So are the four coils that make up the front springs; the rear wheels ride on an old car spring cut in half, with one end bolted and the other free. Shocks are from an Austin. The front end is a ¾″ pipe with a jeep universal joint partly welded to each end. The engine is started by cranking. Private First Class Henry C. Futrell, Fort Bragg, N. C., built the Beep in two months' spare time, spent $100 on it. He gets about 78 miles to the gallon.



Battery Elevator. A lazy tongs extended by a hydraulic jack does the work in this ingenious device for shoving a battery up into place on the underside of an airplane. Master Sergeant Elwin W. Bishop, Air Force ROTC, University of New Hampshire, points out that lifting a 75-lb. battery over your head is no cinch: it's easy to drop it or slop the acid. With his lifter, you just turn the crank and up she goes.

Craftwork Pays Off for Men in Uniform

Popular Science Monthly will pay $18.75 for every craftwork project by men or women in the armed forces accepted for this department. Send photographs and captions only to Craftsmen-in-Uniform Editor, Popular Science Monthly, 353 Fourth Ave., New York 10, N. Y. Although effort will be made to return material accompanied by postage, the editors can assume no responsibility for this.

In addition, the makers of the King Midget automobile, shown above, will send one, to any address in the continental U. S., to the contributor of the most interesting item received before August 1, 1952.

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Detroit Designs a Super Hot Rod

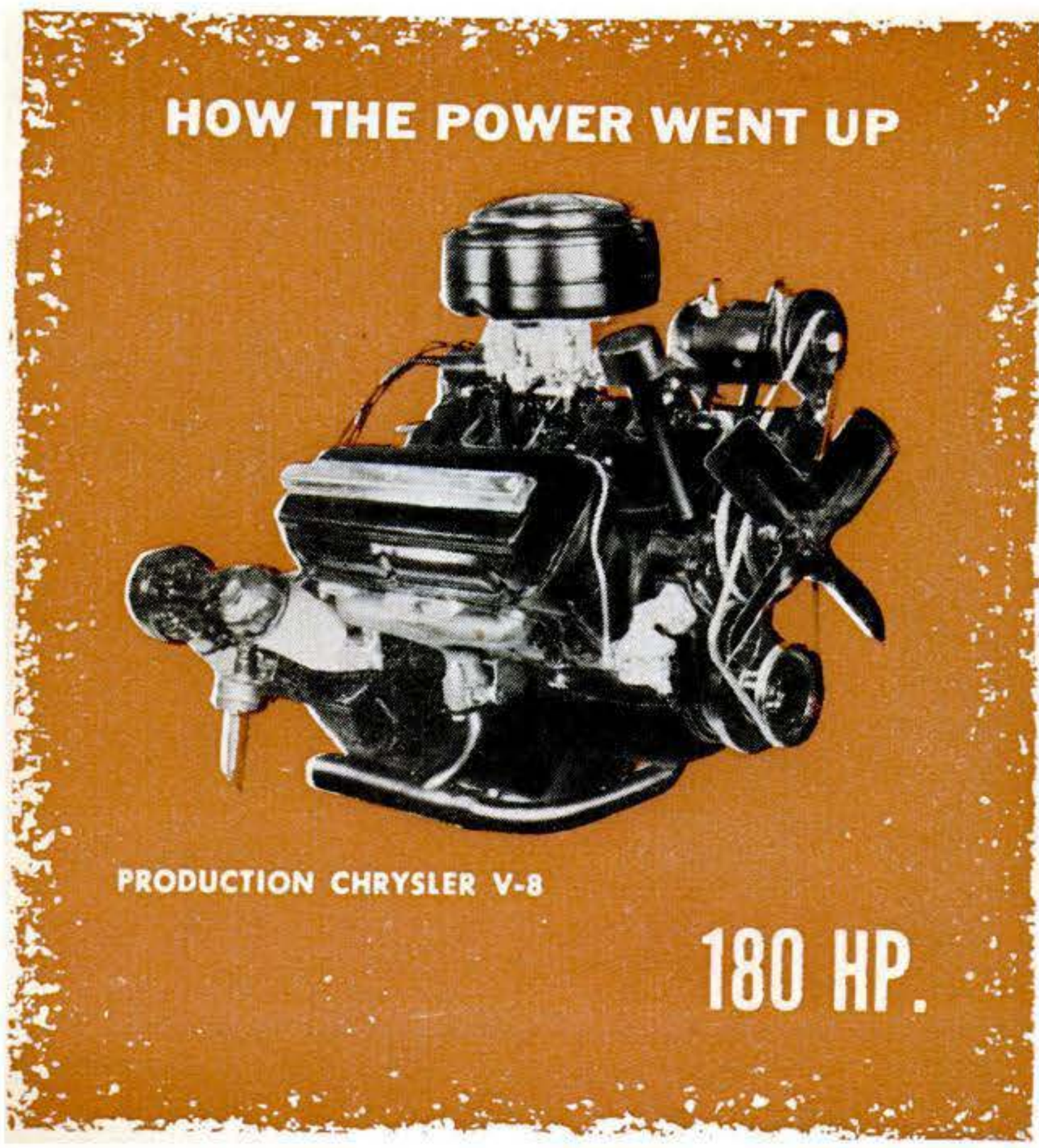
Chrysler engineers took a hemispherical-head V-8 and souped its 180 horsepower to a whopping 353. Here is the step-by-step story of how they did it.

By R. P. Stevenson

A TEAM of hard-working automobile engineers who are supposed to concern themselves with strictly stock passenger cars have out-hopped the hot-rodders by souping up a standard Detroit engine to twice its rated horsepower.

The engine is Chrysler's two-year-old, hemispherical-head V-8. The men who skyrocketed its power far above the basic 180 hp. are the same men who are planning the Chryslers you'll find in the showrooms next year—and the years to come.

What they did to the engine comes close, meantime, to inciting any well heeled hot-



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rodder to do likewise. For, the results, ranging up to 353 hp., were achieved by the classic hop-up gambits:

- High compression.
- Multiple carburetors and special intake manifolds.
- High-speed camshafts.
- Larger valves and ports.
- An open, low-pressure exhaust system.

What the Chrysler engineers wanted to know was the full potential of their engine.

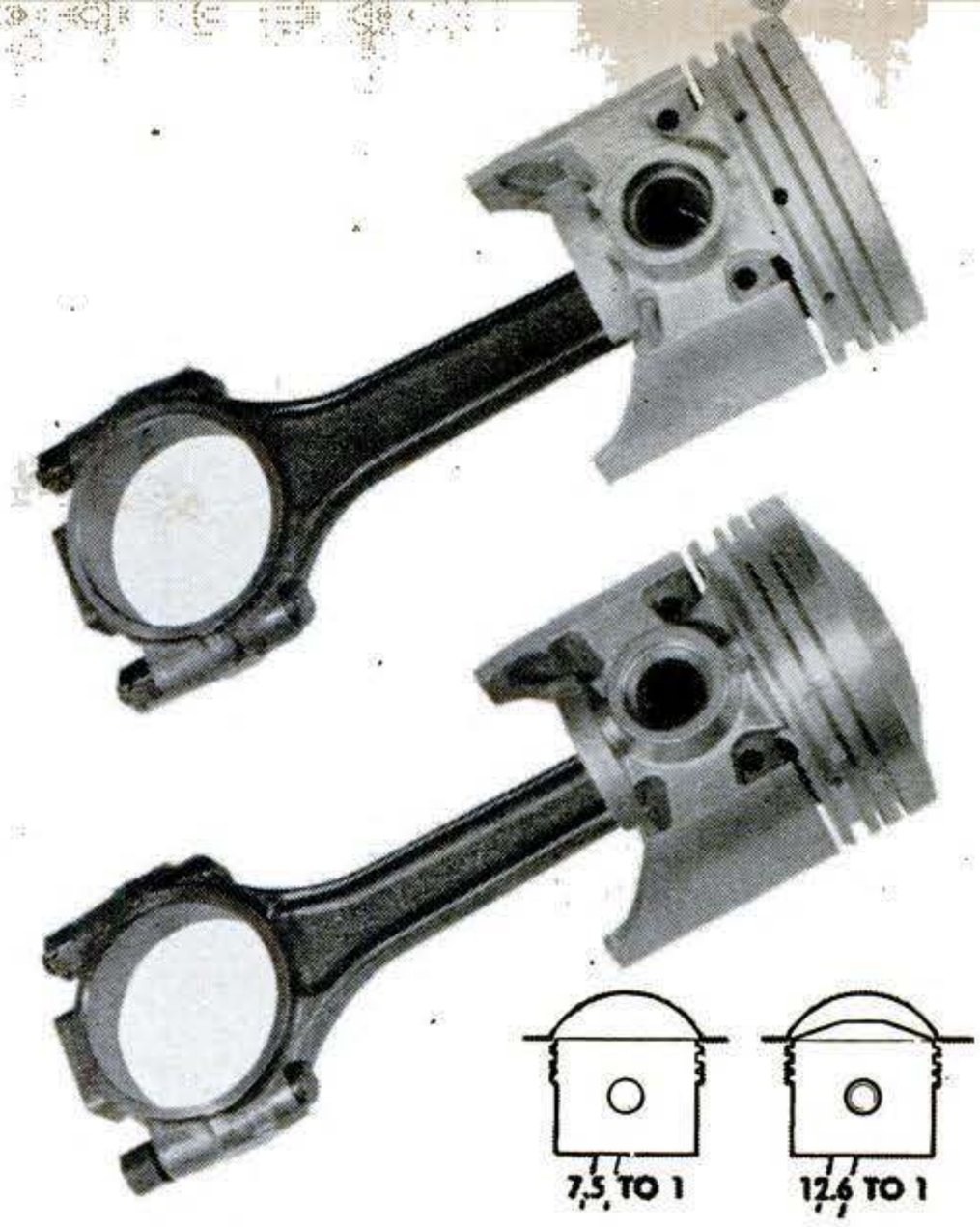
Tackling high compression first, they pulled one of their hemispherical-head V-8s off the production line and tested it at ratios as high as 12.6 to 1.

High Compression Saves Gas

Hot-rodders increase compression by shaving the head or installing a special one. For the present, the Chrysler experimenters left the hemispherical heads strictly standard and changed only the pistons. By raising the normally flat top of each piston, they reduced the space left for the fuel-air mixture at the top of the stroke. The production engine was not changed in any other respect.

At a 12.6-to-1 ratio and 4,000 r.p.m., engine output jumped 35 hp. above the 180 at which the engine is rated with the standard 7.5-to-1 compression.

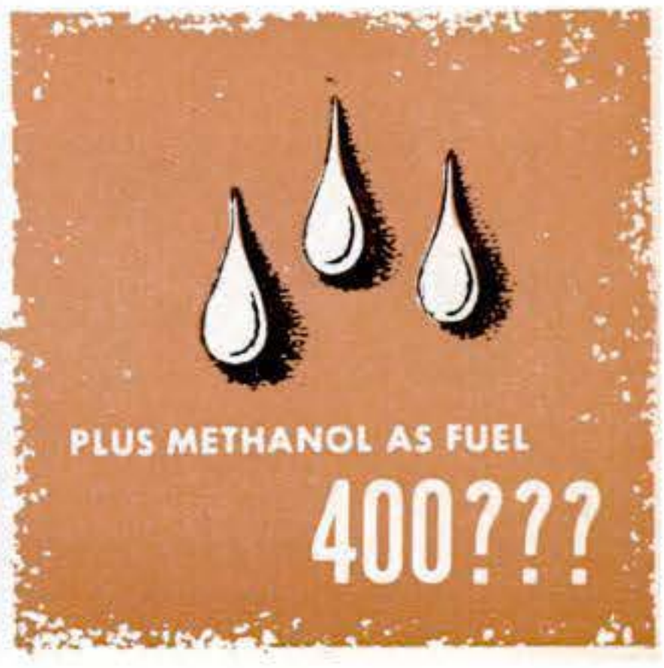
At the higher ratio, the engine also used its fuel much more efficiently. Consumption dropped so low, in fact, that James C. Zeder, Chrysler's engineering and research boss, told the Society of Automotive Engineers that the engine "makes any Diesel with which we are acquainted seem a veritable glutton for fuel."



HIGH COMPRESSION was obtained by raising normally flat top of each piston. As sketch shows, this reduces volume in hemispherical heads—and increases compression ratio. Top piston gives 7.5-to-1 ratio in standard engine; lower one raised it to 12.6 to 1.

Satisfied by these results that the engine would respond nicely to higher-octane fuel if it becomes available, the engineers next decided to see how they could improve performance on ordinary fuels.

This time they chose the path of volumetric efficiency—making the en-



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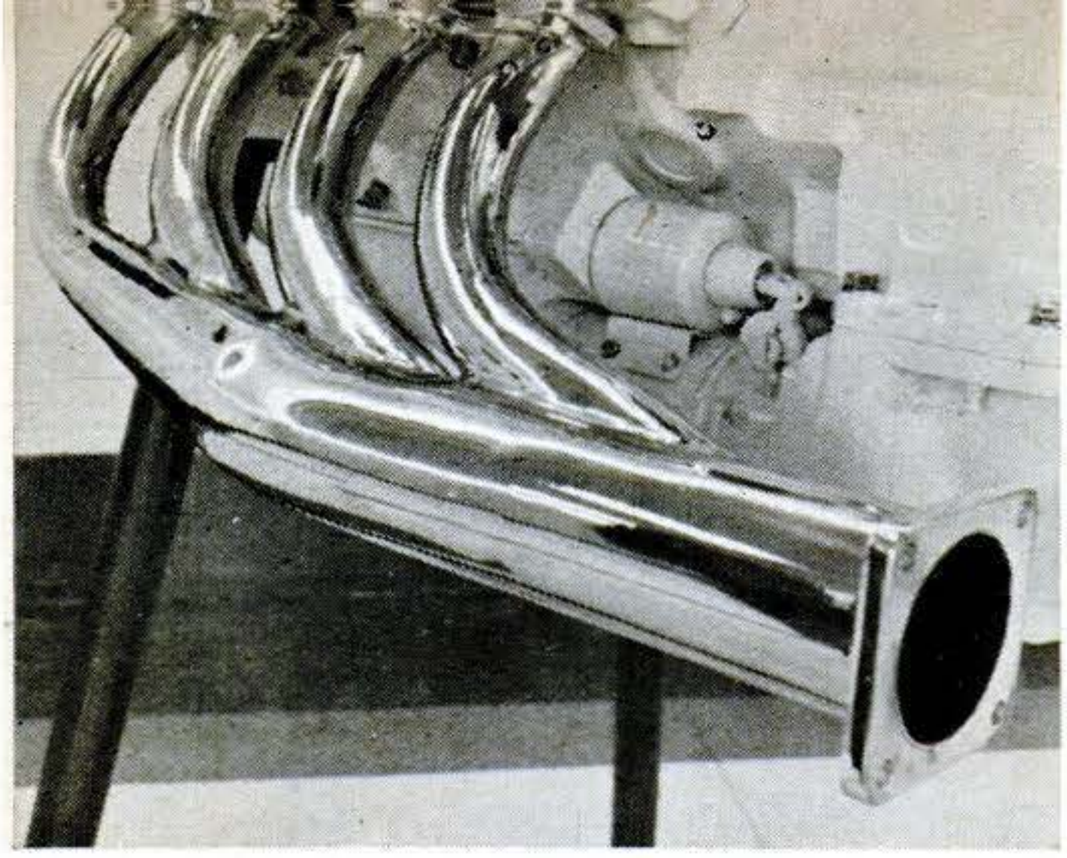


FREE-FLOW EXHAUST MANIFOLD with easy, generous bends reduced back pressure and increased power. Manifold shown was exhibited with Chrysler's K-310 dream car.

gine turn out more power by enabling it to breathe better.

Starting anew with another standard engine, they first set out to see the gain they could get with a less restricted exhaust system. They also blocked off heat from the intake manifold—a trick back-yard soupers have long followed for improving VE.

With this equipment, the engine turned out 193 hp. at 4,000 r.p.m., 13 hp. more than production engines, and the torque peaked about 18 lb.-ft. higher.

Although the new exhaust header was designed without reference to its suitability for use in a car, the same principle later was put into the K-310, the dream car that Chrysler exhibited in major cities last fall (PSM, Feb. '52, p. 99). Twin pipes carry the exhaust to the rear.

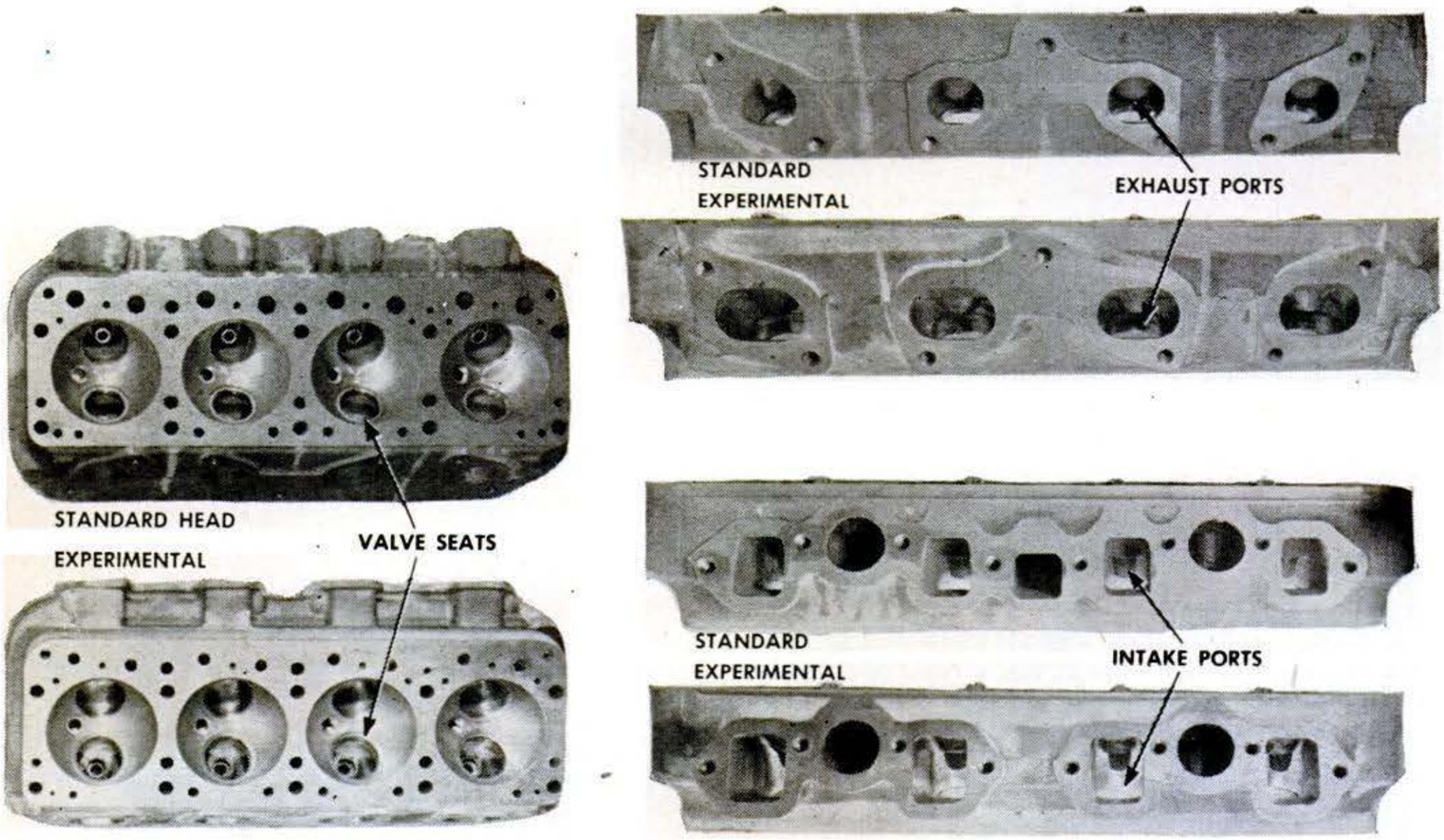
Still keeping the special exhaust, the Chrysler engineers now added nonproduction hemispherical cylinder heads and an intake manifold designed for high torque. In the special heads, the diameter of the intake valves had been increased by ⅛" and the exhaust valves by ¼", with the ports enlarged to match. These special heads were retained throughout all succeeding tests.

A Carburetor for Every Cylinder

The intake manifold adopted for this part of the experimental work used four single carburetors, each one arranged to feed two cylinders—but at intervals of 360°. This means that a cylinder gets the carburetor's full charge on each intake stroke.

After the special heads and intake manifold had been added, the peak speed jumped nearly 1,000 r.p.m., and power shot up about 42 hp., raising the total to 235 hp. The torque curve rose more sharply and peaked some 30 lb.-ft. higher than it had before.

These results gave Chrysler something to think about, since they were accomplished by comparatively simple mechanical changes that could easily be carried to the production line. They put out 20 hp. more than had been gained from raising the compres-



LARGER VALVES AND PORTS were used in the experimental engine to improve volumetric efficiency. Diameter of the intake valves was increased by ⅛", the exhaust valves by ¼".

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sion ratio to 12.6 to 1. And the engine remained happy on easily available premium fuel.

Not yet content, the Chrysler engineers next turned to valve timing, feeling that some increase in valve opening would promote their search for power despite possible disturbance of the smooth idle. To do this, they pulled out the standard camshaft, which gives a 252° intake duration and a 244° exhaust with a 30° overlap.

Three Camshafts—All Hot

For test purposes they developed three special camshafts, resorting to an electronic computer to carry out the intricate mathematics required. Physical characteristics of the new cam lobes remain Chrysler's secret, but the three new shafts keep the valves open as follows:

A 260° intake, 260° exhaust and 40° overlap.

A 270° intake, 260° exhaust, 50° overlap.

A 280° intake, 270° exhaust, 60° overlap.

In practically all cases during the tests, the special camshafts were installed so the overlap was symmetrical—a 40° overlap, for instance, ran from 20° before top dead center to 20° after it. Each of the special cams increased the valve lift.

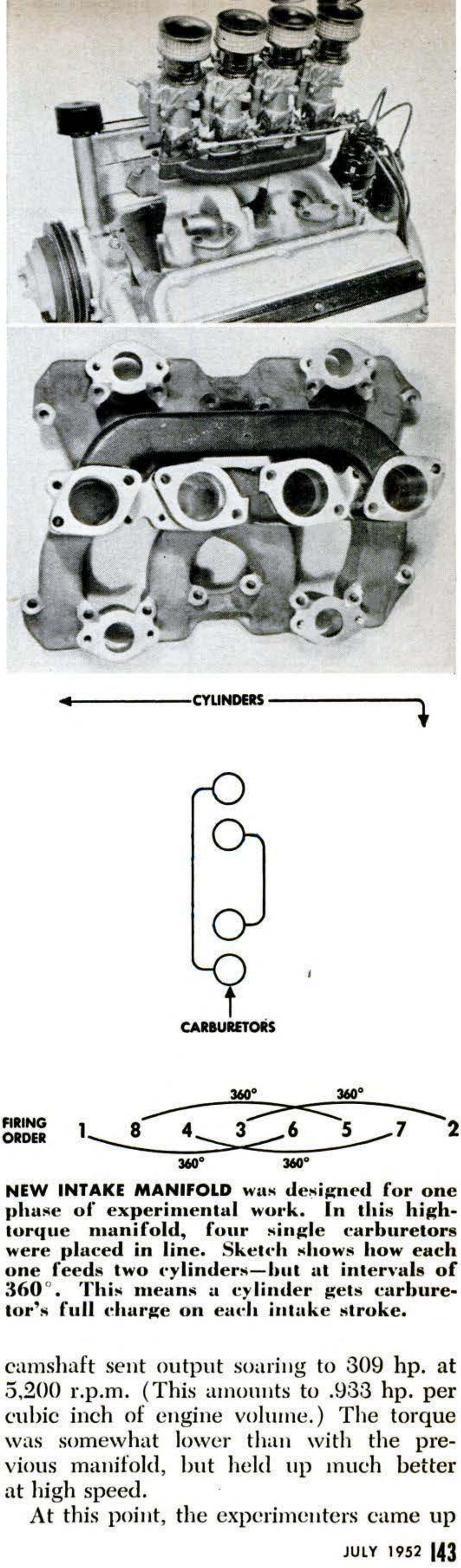
New Manifold Boosts Power More

One after another, the three special cams were run through tests with the same engine components previously used. In general, as the timing intervals were lengthened, the power went up. However, the longest-duration camshaft, the 280°-270°-60°, did not add appreciably to the power and was slightly lower in torque. All in all, the middle shaft, the 270°-260°-50°, gave best results. Peak speed was increased by 500 r.p.m., torque by 12 lb.-ft., and horsepower by 40, raising the total output to about 275 hp., 95 above the production engine's 180. The idle performance of all these camshafts proved reasonably acceptable.

On the hunt for still more power, the experimenters then substituted an intake manifold of the double-runner type and conducted duplicate tests with all three special camshafts. Each manifold was fed by two single carburetors between pairs of ports. A single crossover in the center provided balance between the two manifolds.

Again the engine responded. Both power and torque increased progressively with increase in valve timing. The 280°-270°-60° camshaft sent output soaring to 309 hp. at 5,200 r.p.m. (This amounts to .933 hp. per cubic inch of engine volume.) The torque was somewhat lower than with the previous manifold, but held up much better at high speed.

At this point, the experimenters came up



NEW INTAKE MANIFOLD was designed for one phase of experimental work. In this high-torque manifold, four single carburetors were placed in line. Sketch shows how each one feeds two cylinders—but at intervals of 360°. This means a cylinder gets carburetor's full charge on each intake stroke.

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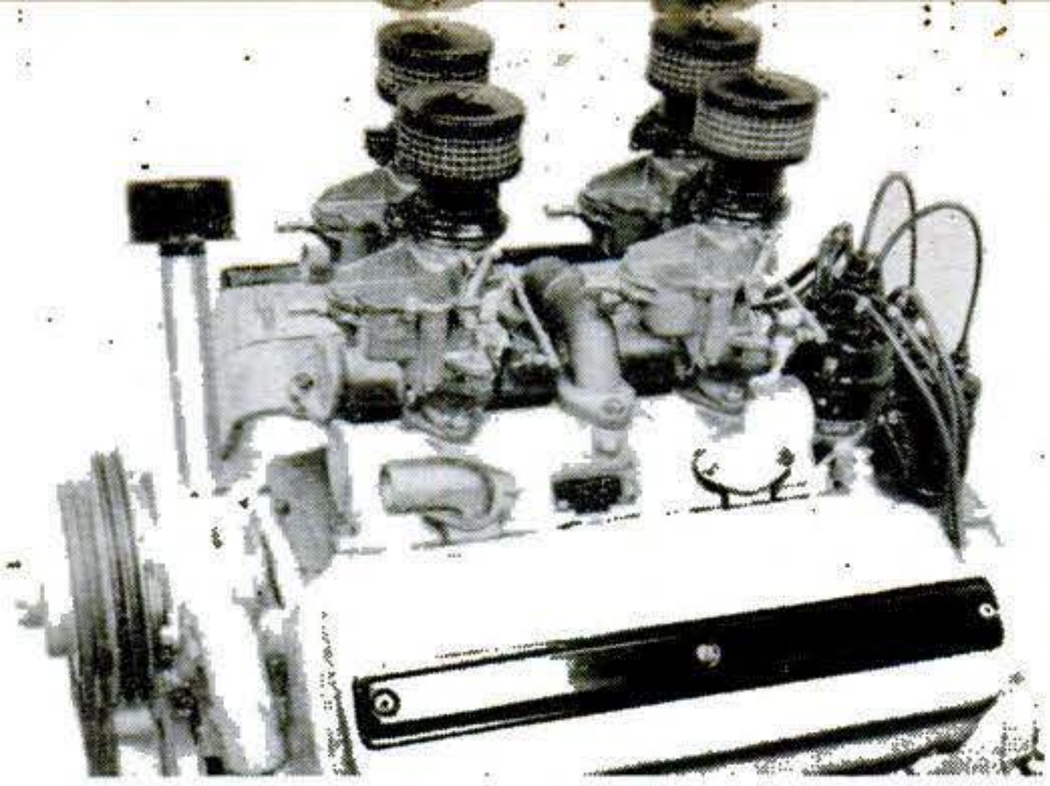
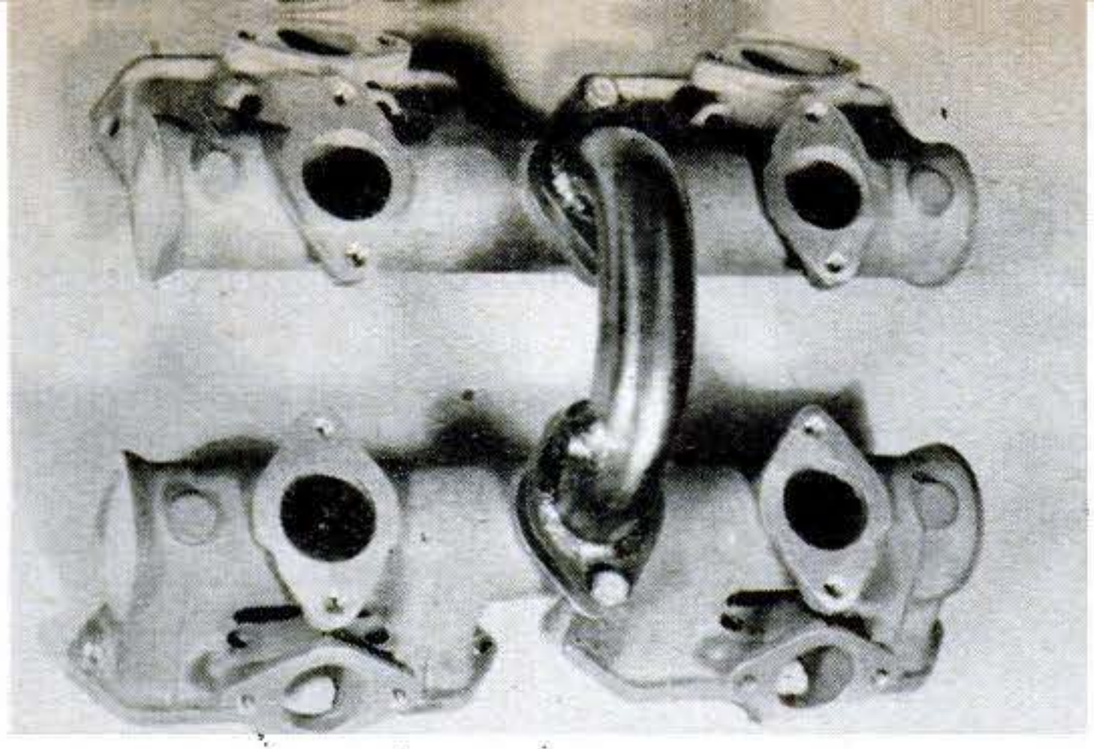




PAIR OF RUNNER MANIFOLDS was used for high-power experiments. In this case, each manifold is fed by two carburetors. These manifolds were used on display engine below.

for air and took the wraps off the engine. You may already have seen it. It was the flashy power plant that the Chrysler Corp. exhibited along with the K-310 car last fall.

But the engineers were not through yet. There still were a couple of power-boosting steps they wanted to try.

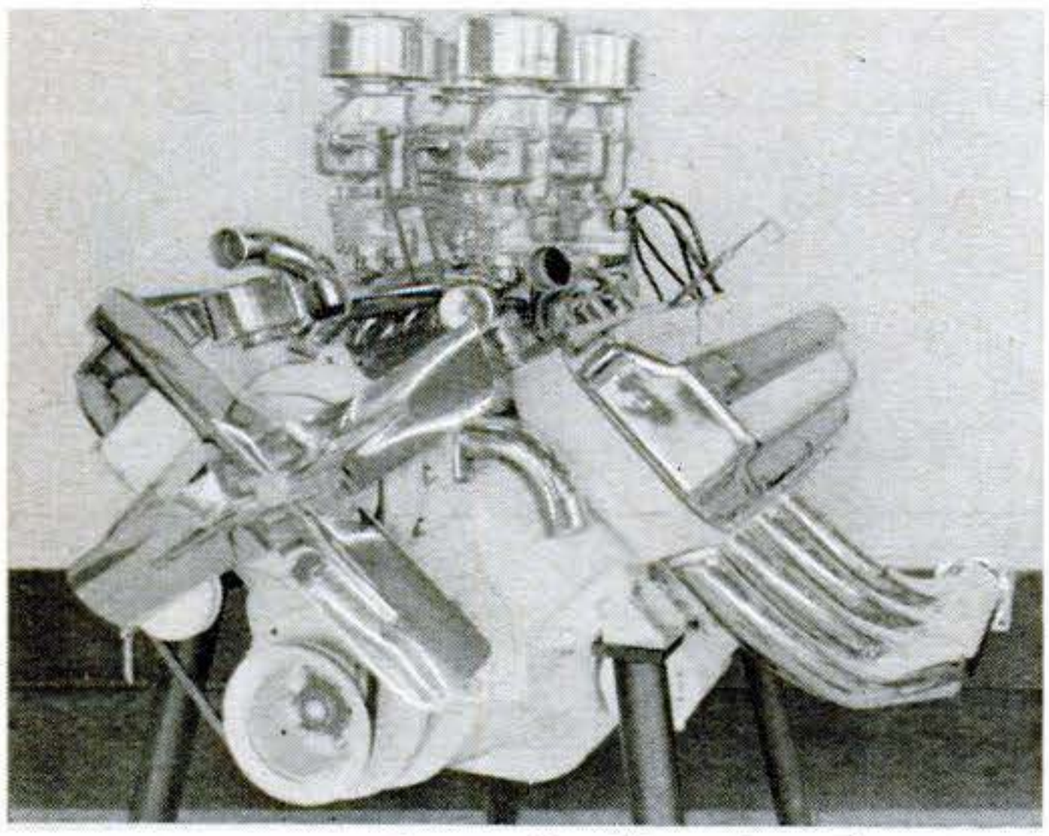
First, they increased compression to 12.6 to 1 as they had done before. Along with the better breathing components, this now turned out a whopping 353 hp. at 5,200 r.p.m.—1.07 hp. per cubic inch.

For this run, the quality of the fuel was raised to the best that could be made—the equivalent of iso-octane plus one cubic centimeter of tetraethyl lead per gallon.

And now Mr. Zeder speaks:

"It is significant that, with the latter fuel, the basic FirePower cylinder gives performance comparable with the Indianapolis engines, which have been developed for power without regard to any other purpose.

"Since these competition engines frequently use methanol, it was decided to run a final test of the potentialities of the FirePower engine using the same fuel. These tests are in progress. We prefer not to present any data until the tests are complete. There is no question, however, that the results are sensational."



DISPLAY ENGINE shown by Chrysler along with its K-310 dream car was a dressed-up version of experimental power plant. As shown, engine would turn out 310 hp. on ordinary gas.

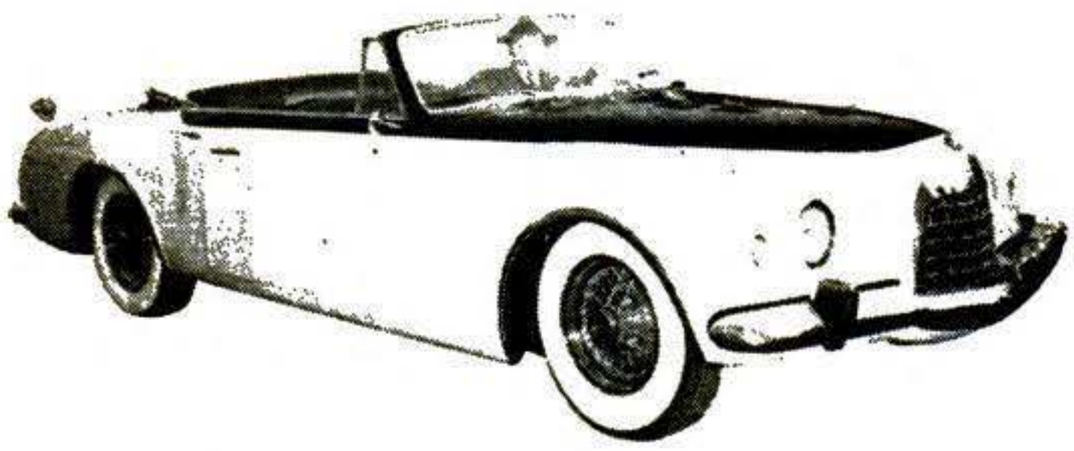
Next Stop 400 Hp.?

The Chrysler people are still not saying just what they found. But they do not deny that the output might be around 400 hp.

What do they intend to do with all this power? Chrysler does not suggest putting it into highway cars; such power is practical only on the tracks.

But power can be used for purposes besides speed. In the Chrysler tests, the efficiency of the engine rose right along with the power. If carried to production engines, this would enable you to make fewer visits to the gas pumps.

The manufacturer could also translate the extra horsepower into a more compact engine. With a smaller engine, the whole car could be made smaller and cheaper. END



NEWEST CHRYSLER EXPERIMENT. Custom-built in Italy, this convertible was designed by Chrysler engineers to blend European sports-car styling with American engineering features. You can't buy one like it, but it certainly is a signpost to future designs. Will it be used as a test vehicle for a high-output engine? Chrysler isn't talking.

Do you save copies of PSM? See the index of Mechanics & Handicraft articles in Volumes 159 and 160 on pages 187 and 191.

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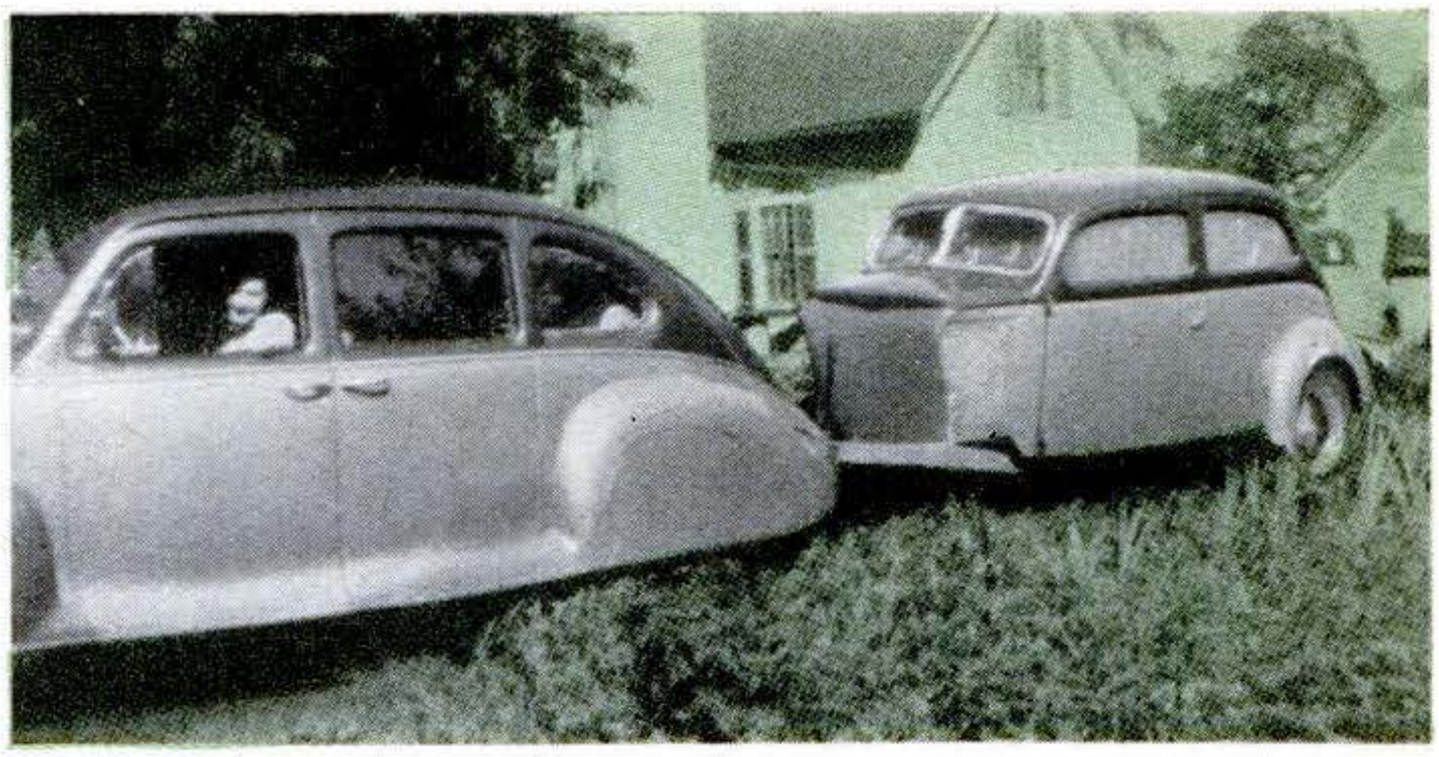
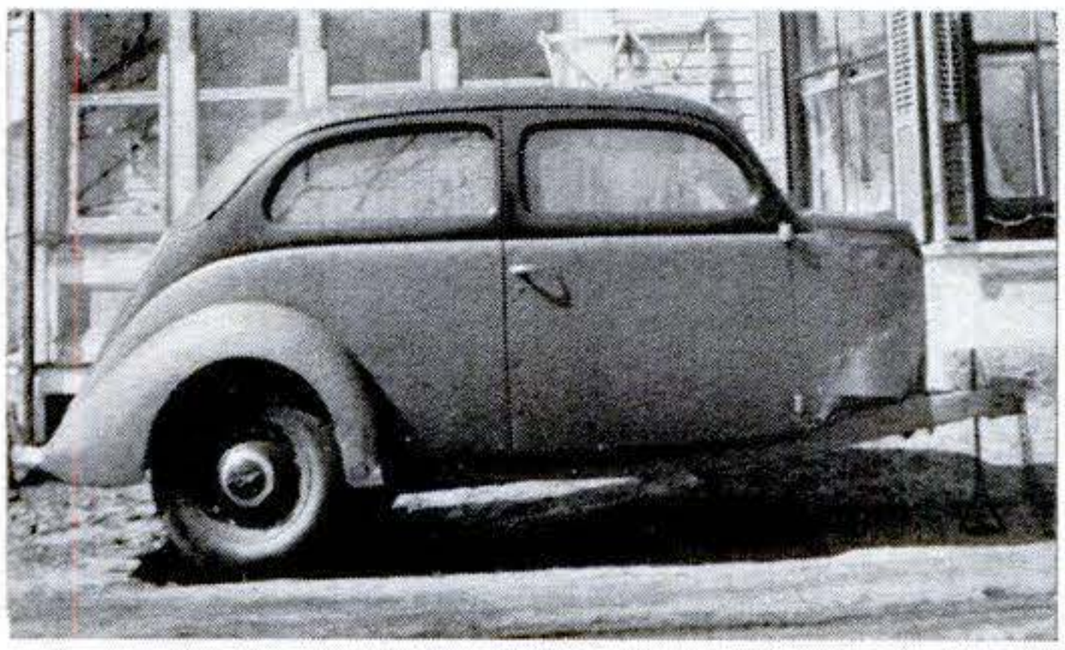
SETTING OUT ON VACATION, here's how we look. The trailer originally was a 1937 Ford two-door sedan picked up at a junk yard, with fairly good tires, for $10. I chose this car because it is light and has an all-steel top and body and a good-size trunk.



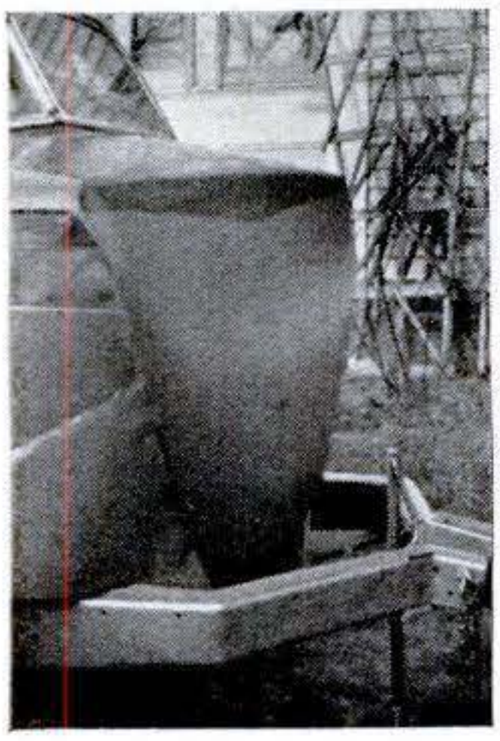
My Trailer [illegible] Sal

By G. E. Griswold

Stripped of its engine, front end and seats, a 1937 Ford gives me perfect sleeping accommodations for camping trips.



MODIFICATIONS I made can be seen in close-up view. Everything unnecessary was discarded—engine, entire front end (including steering wheel and post), running board, drive shaft, pinion gear. Hand brake was left hooked up and a plug installed to connect tail light to the electrical system of the tow car.



AT THE FRONT, cross member was removed from frame and the sides bent together and welded to a trailer hitch. I then installed a screw-type jack in the angle of the frame to support the trailer. The hood was simply bent down and welded to the sides of the frame.

INSIDE OF CAR offered enough space for a three-quarter bed spring after removal of seats. Back of rear seat was left, however, as a back rest for reading in bed. After I removed the window moldings and installed screening, my wife put up the curtains that you see above.

What I Gained: The entire trailer cost me only $32.50. The excess above the $10 car cost went for welding, the hitch and jack, bed spring, screening and paint.

The job took me only a fraction of the time that would have been required to build a conventional trailer.

Weighing less than 850 lb., the trailer handles well and never has taxed the tow car in any way.

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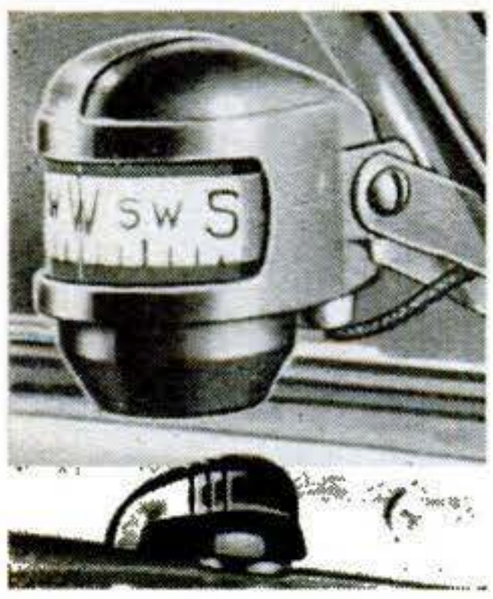
For Your Car...

Sun Hat Cools Car

DESIGNED for use in desert areas, this allover visor allows air to circulate between it and the top of the car, carrying away heat that otherwise would penetrate into the car. Hooks and suction cups attach it, and the frame keeps it 5″ above the car roof. The visor extends about 20 inches over the windshield, and also shades the rear glass. Made of canvas or plastic on a steel frame, it weighs 28 pounds. *Dr. O. M. Williamson, Sedona, Ariz.*

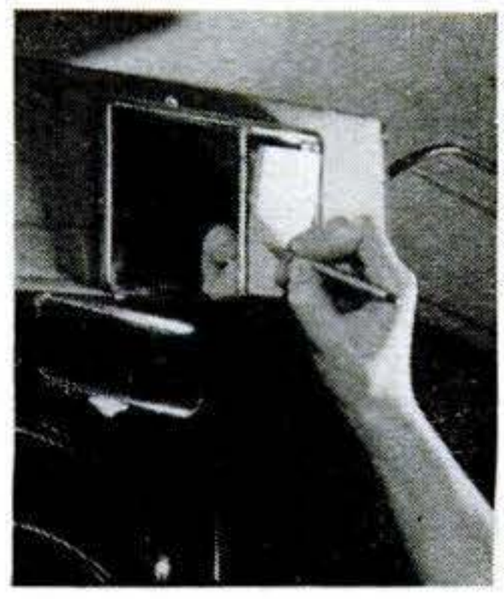
Compass Has Light Inside



AN ILLUMINATED car compass for mounting on the windshield divider is a Pontiac accessory. It comes in a chrome-trimed gray plastic case. The lamp is wired to the car's electrical system.

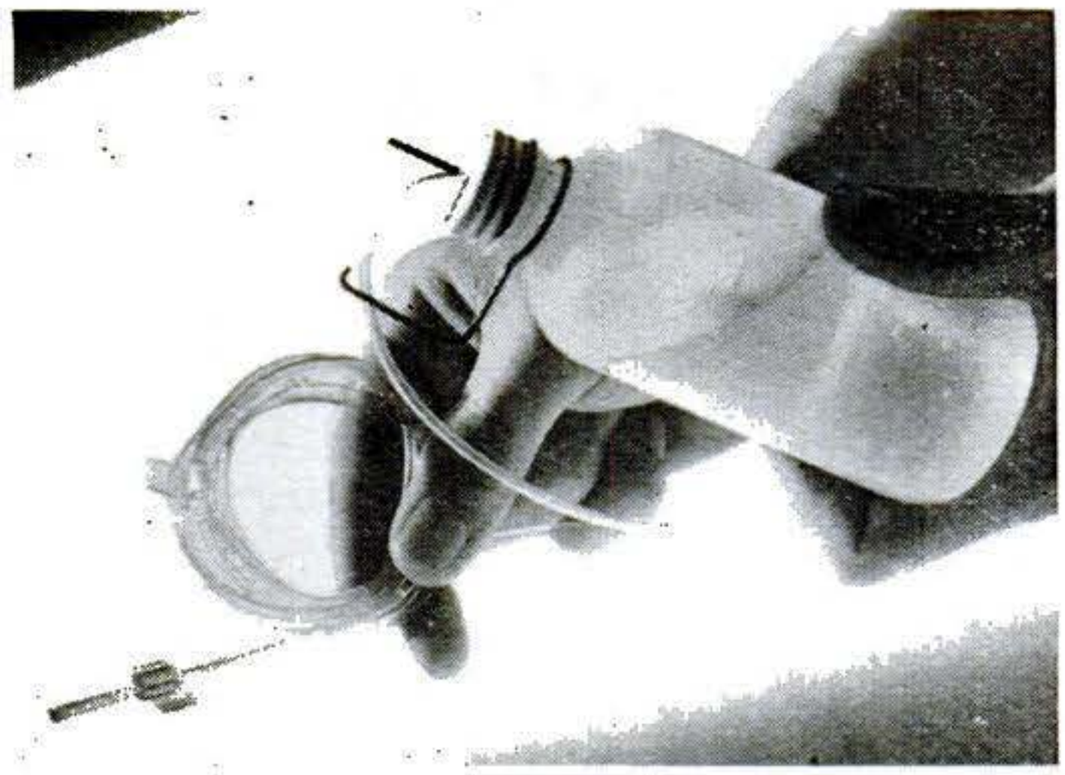
Magnet Holds Pencil on Visor

HERE is a combination mirror and note pad for mounting on the back of the sun visor. A magnetic pencil clings to the Visor Wizard mirror frame. *Dreer's, 1934 Arch Street, Philadelphia 3.*



Armrest Gives Storage, Too

BESIDES providing a padded spot for your elbow, this armrest opens up for storage of maps and other auto odds and ends. A wire holds it in place. *Car-Y-All Co., 89-70 220 St., Queens Village, N. Y.*



Squeeze Washes Windshield

SQUEEZING this plastic bottle sprays water over the windshield from holes in the plastic tubing. Squeeze Me hooks to the instrument panel; the tubing runs through the fire wall or between the door and frame, and clips to the lower edge of the windshield. It fits all cars. *Denton Hassel Co., Ferndale 20, Mich.*

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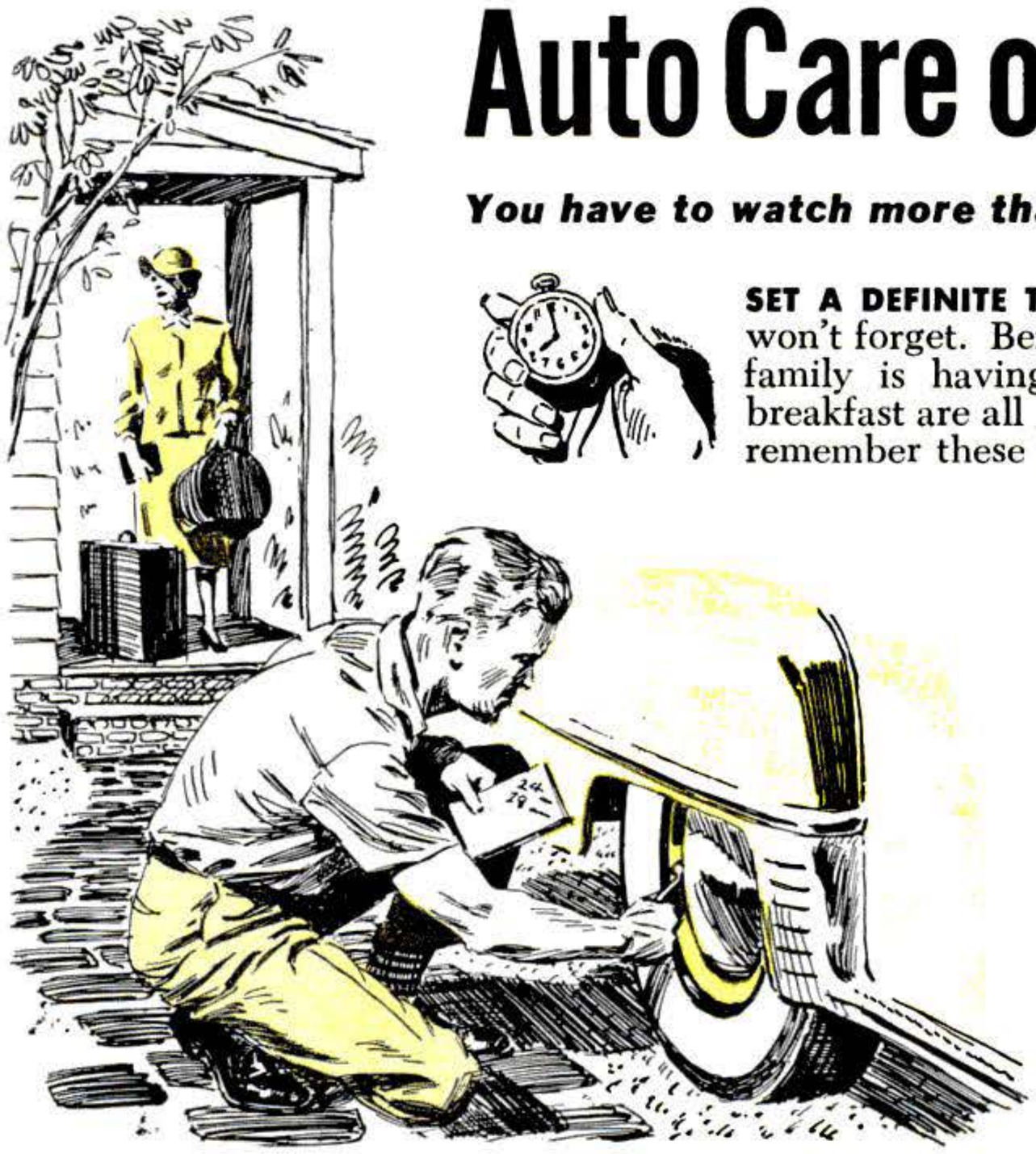
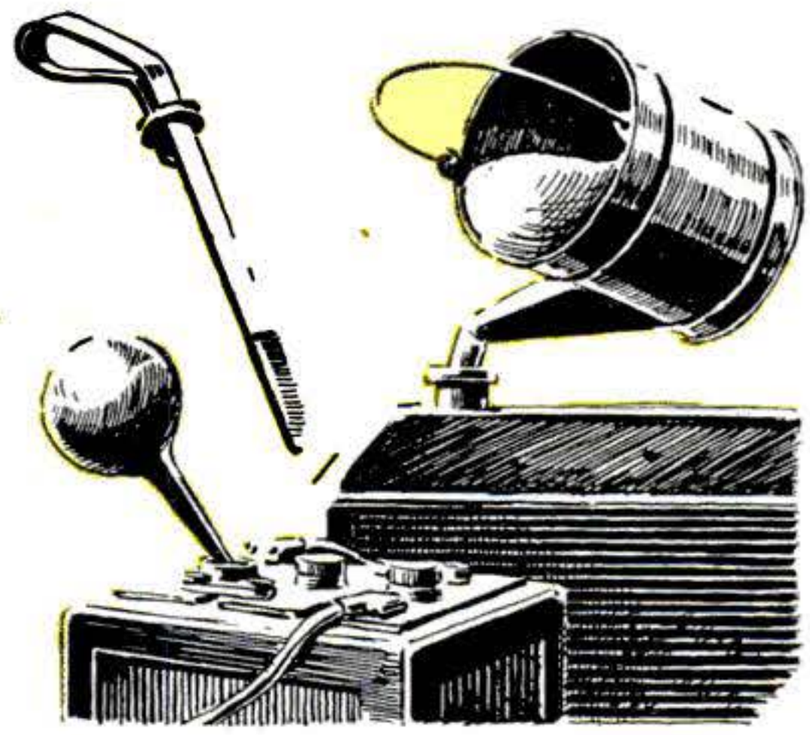
Auto Care on the Highway

You have to watch more than the scenery for a pleasant trip.

SET A DEFINITE TIME to service your car each day so you won't forget. Before starting out in the morning, while the family is having breakfast, or the first rest stop after breakfast are all good choices. Besides filling the gas tank, remember these other points:

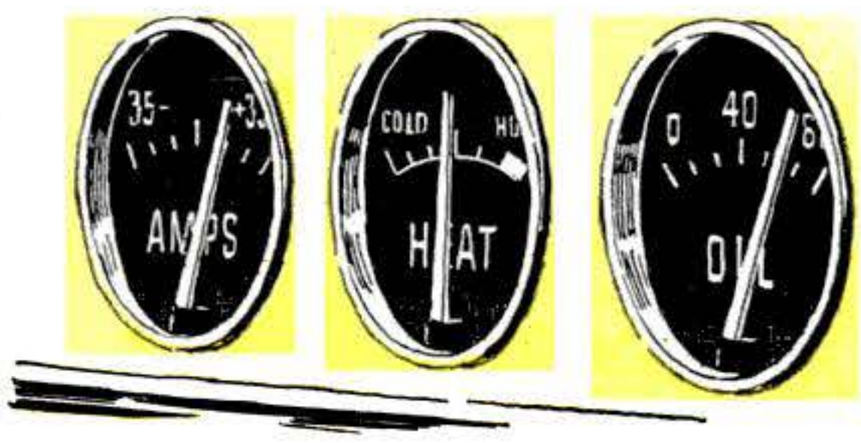


1 ADD AIR TO TIRES IF NEEDED. Gauge them first thing in the morning before moving car—while tires are cold. If you can't add air immediately, make note of how many pounds any tire is below recommended pressure. Then, at service stop, add just this many pounds—even if it brings the total above approved "cold" figure.



2 CHECK OIL, WATER, BATTERY. Remember that on one day of touring your mileage may equal weeks of ordinary driving. Check oil every time you refuel—even if your car never burns oil.

3 EXAMINE ENTIRE CAR quickly while attendant is cleaning windshield. Visual inspection can uncover such things as tires worn by misalignment, a loose or worn fan belt, or an oil leak around a gasket. Make sure stoplight and turn signals are working properly.



WHILE DRIVING, keep your eye on the ammeter and oil and temperature gauges, as well as the scenery. They are there to warn of trouble in the making.

DON'T REFUEL in the afternoon or evening on very hot days if you can possibly avoid it. The summer sun expands gasoline in underground tanks and you get less fuel energy from each gallon.

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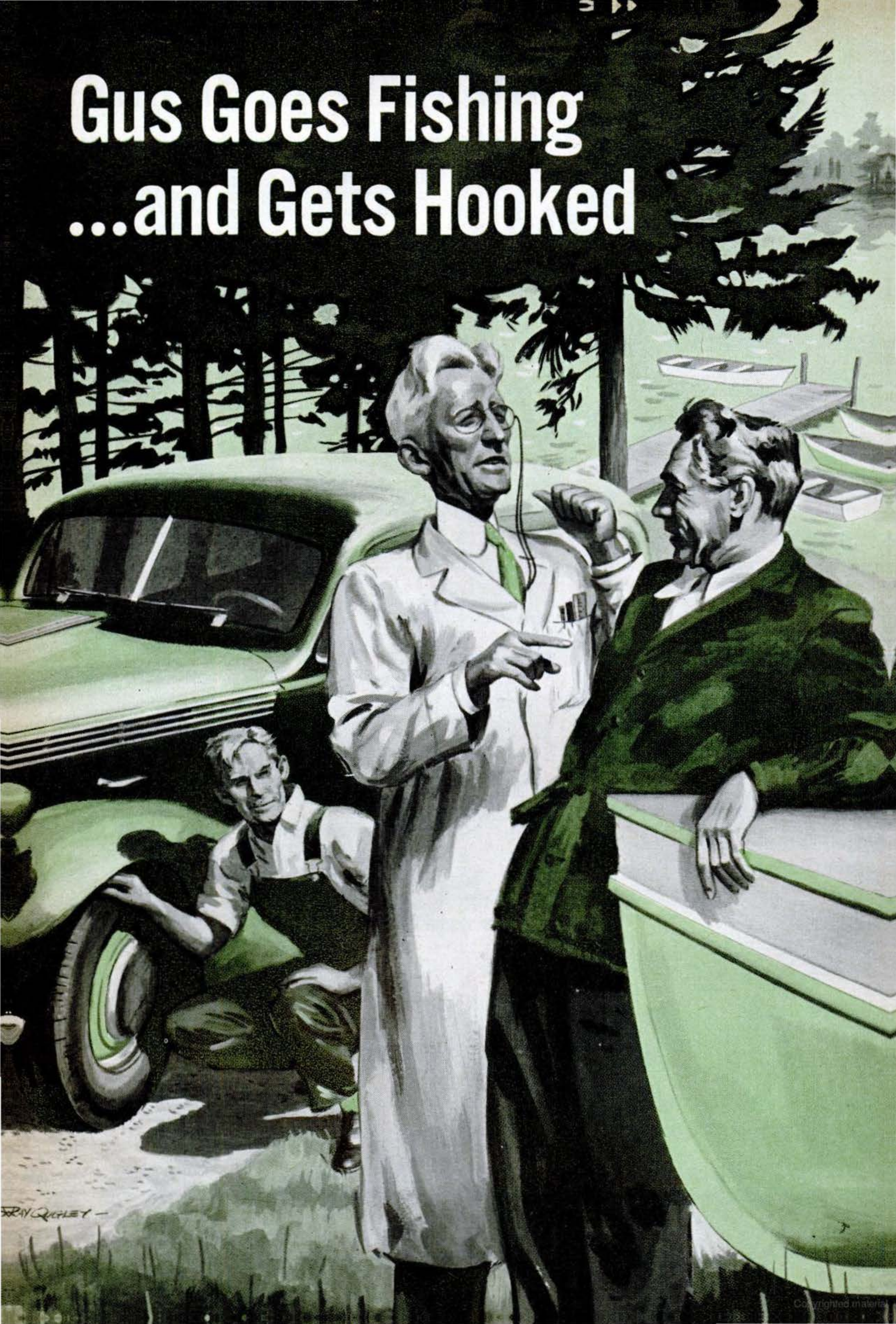
Gus Goes Fishing ...and Gets Hooked



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All Gus wanted to do was fish but he couldn't resist the temptation to show the stiff-necked, mule-stubborn Dr. Angus that it takes more than theories to fix a balky car.

By Martin Bunn

AS HE steered around a sharp bend in the narrow dirt road, Gus Wilson finally caught sight of what he had driven more than 200 miles to find.

It wasn't a big lake, but it looked like the answer to an angler's prayer. It had weed beds, sunken logs and a nook-and-cranny shore line. Everything about it spelled FISH. And that's just what Gus, with a few days off from his Model Garage, was after.

"Now to find that little hotel Jim Worden told me about," he muttered happily to himself, "and I'll be all set."

Driving on slowly he came to a winding lane that led down toward the lake. And sure enough, right there on the shore was a long, low one-story building.

Hotel Appears Deserted

Gus parked in front of the hotel. There were two other cars, and as he unloaded his gear he noticed that the front end of one was jacked up, with the front wheels and hub assemblies missing.

When he got no response to repeated knocking, he opened the door and walked in. No one seemed to be around so he settled himself in a big chair to wait. The only sound was a low humming noise that seemed to come from a hall leading off to the left.

Suddenly the humming stopped and Gus heard a door slam somewhere. The next thing he knew a tall, spare, bespectacled man in a long white coat was standing beside his chair peering down at him.

"I am Alvin Angus," the stranger said evenly. "And what can I do for you?"

Gus, a little taken aback by the man's sudden appearance, was annoyed to find himself stammering. "Why—er—I'm Gus Wilson, a friend of Jim Worden's. He suggested I come up here for a few days' fishing. This *is* a hotel, isn't it?"

"Yes indeed. I have a vacant room right down the hall. Please follow me."

Feeling a bit nonplussed, Gus picked up his gear and followed.

Angus stopped in front of the second door along a narrow hallway and swung it open to reveal a neatly furnished room.

"Here you are, Mr. Wilson. Dinner is at seven. If you need anything in the meantime, I'll be in my laboratory."

Gus was about to ask, "Where is that?" but before he could get the words out of his mouth the man was gone.

"Mighty odd character," thought Gus as he unpacked. With his white doctor's coat and "laboratory," Angus made the place seem like some sort of sanitarium instead of a fishermen's retreat. But if the fishing was as good as Jim had bragged it was, Gus didn't care if Dracula himself ran the place.

Gus Meets a Fellow Fisherman

A few minutes later, fishing rod in hand, he strolled contentedly down toward the lake. A pleasant-looking middle-aged man was just easing a skiff up to the dock.

"How's the fishing?" called Gus.

"Wonderful!" The man held up a couple of good-sized bass.

"I'm Gus Wilson," said Gus as the fisherman clambered up on the dock.

"Glad to know you. I'm Bill Plummer.

"I hardly think you could be of much assistance in this case, Mr. Wilson," Dr. Angus said coolly.

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Planning to spend a few days up here with the good doctor?"

"Doctor?"

"Yeah, Dr. Alvin Angus—the fellow who owns the hotel. Haven't you met him yet?"

"Well—yes. What is he—a physician?"

"Oh no, he's a retired scientist. He runs this place, and he spends a lot of time in what he calls his laboratory—it's really more like a glorified workshop. Incidentally—" Plummer grinned—"don't get into an argument with Angus. He's the kind of guy who's always right about everything."

Fish Jump Right onto the Hook

The fishing *was* wonderful. In a little over an hour, Gus reeled in a largemouth bass and a couple of nice lake trout.

That night he got a chance to talk to Dr. Angus. After a good dinner, served by a widow neighbor who cooked the meals, he, the doctor and Bill Plummer settled down on the back porch overlooking the lake.

Under Gus's friendly prodding, the doctor unbent a little and told how he'd spent many years as a research physicist and university professor. Then he had retired on the advice of his doctors and opened the fishing camp.

"After a lifetime of that sort of stuff," Gus put in sympathetically, "you must find it pretty dull catering to a bunch of guys who don't want to talk about anything but fishing. After all, scientific research is a pretty special kind of business. Most of us don't know much about it."

"But you should," snapped the doctor. "That's just the point. There is a scientific approach to every subject. I find, for example, that the practical problems I deal with in my laboratory yield to analysis exactly the same way that purely theoretical ones do."

Gus was getting interested. "That's certainly true up to a point." He was thinking of how he had licked many a tough problem at the Model Garage by just lighting his pipe and sitting down to think it over. "But of course you've got to have a lot of practical knowledge and experience before you can start analyzing."

"Can't agree with you on that. Fundamental principles apply to everything. No specific experience required."

Gus Beats a Hasty Retreat

Gus caught the sly grin on Plummer's face and suddenly remembered his warning about arguing with the doctor.

"Perhaps you're right, Doctor. I hadn't thought of it just that way. Well, I guess I'll turn in—want to get an early start on that fishing tomorrow."

Dr. Angus seemed somewhat mollified. "Come see my lab for a minute. Like to show you some of my equipment."

The doctor's "laboratory" was as neat as a laboratory should be, and elaborately outfitted. On one side of the room was a complete metal shop right down to a small shaper. On the other was a fully equipped woodworking shop.

Gus whistled admiringly. "This is really something. What sort of work do you do in here?"

"Oh, I've made some furniture for the hotel, and various odds and ends. And lately some of the local people have discovered that I have this shop and have been bringing me their repair problems. Only today, a chap who lives down the road brought his car in. He had bought a set of brake shoes by mail but when he started to install them he found his front-wheel drums badly scored. Asked me if I'd turn them down. I did so. And by the way, Mr. Wilson," Angus went on, waggling an emphatic finger, "that's a case in point. I know very little about automobiles but I predict that Clem Lamson's brakes will now operate perfectly."

Dr. Angus Runs into a Problen.

Gus recalled the jacked-up car out in front of the hotel. "Well, no doubt you're right," he said mildly. "See you tomorrow."

Up early as usual next morning, Gus decided to take a walk before breakfast. As he opened the screen door, he heard voices raised in argument. The doctor and a man in overalls were crouched down beside the left front wheel of a car in the driveway.

[*Continued on page 198*]

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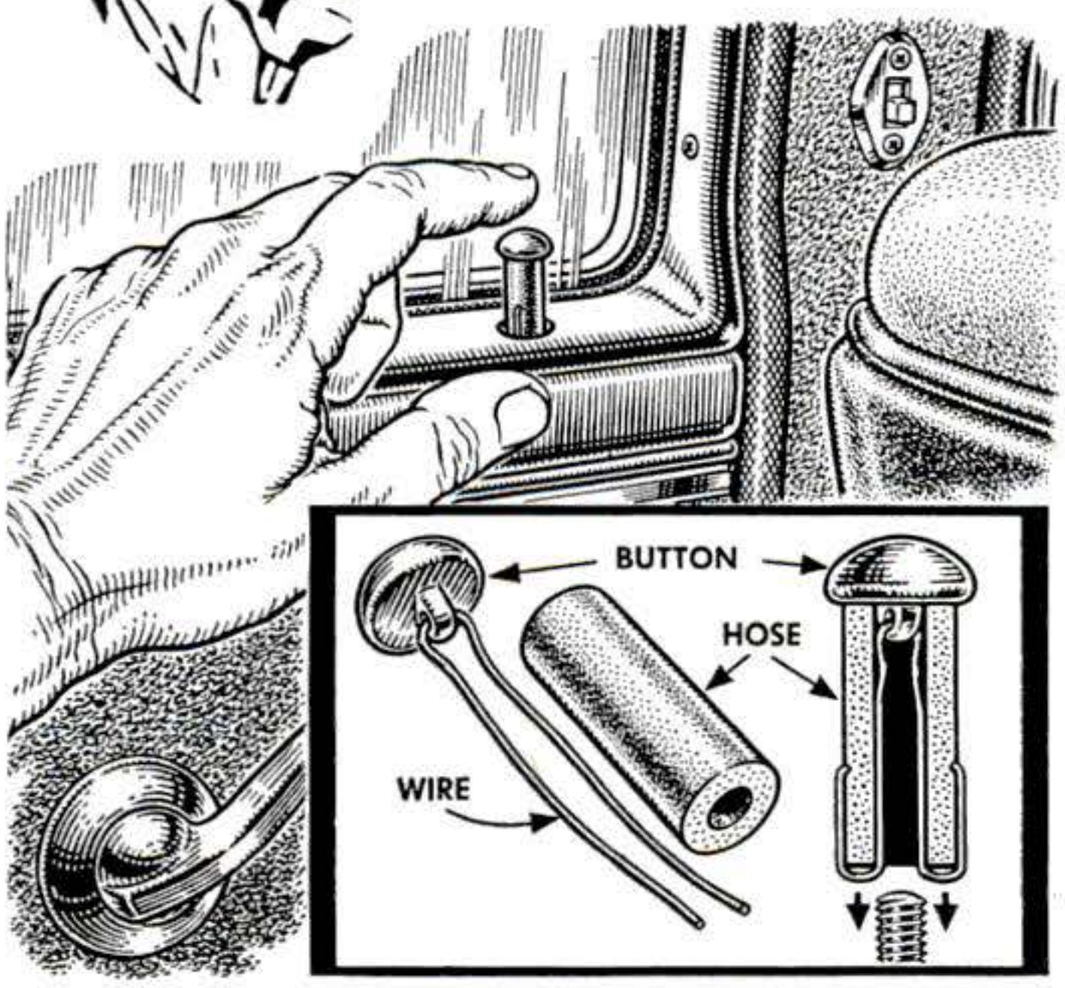
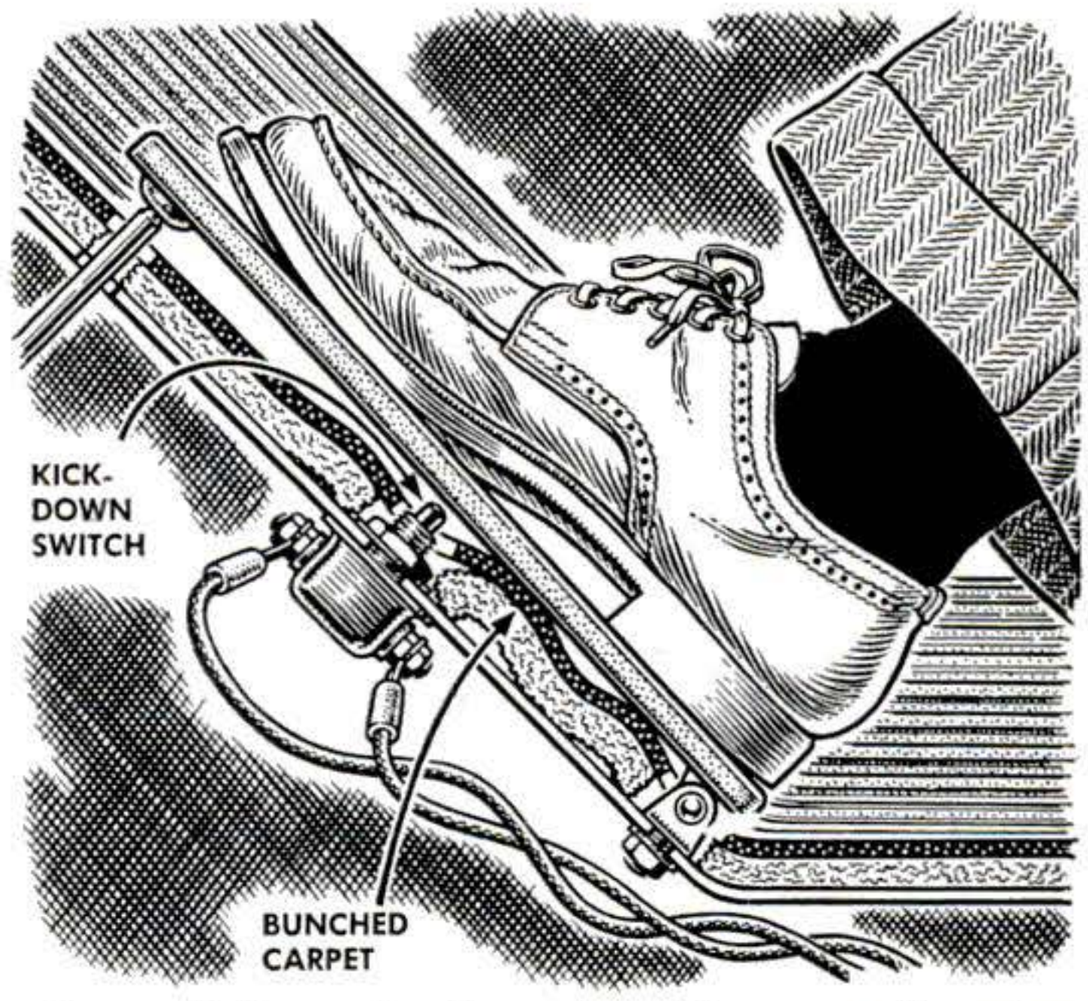
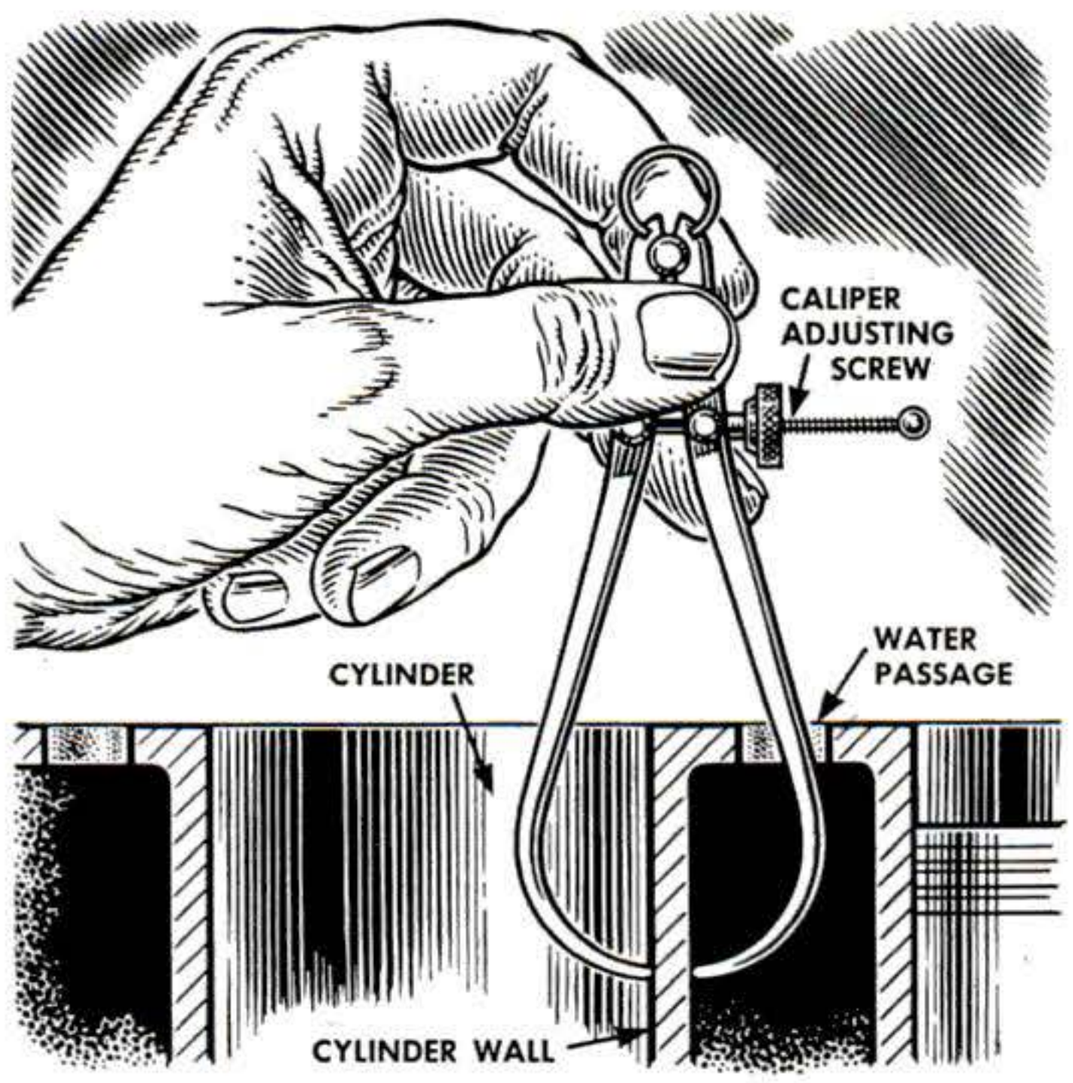
Hints from the Model Garage



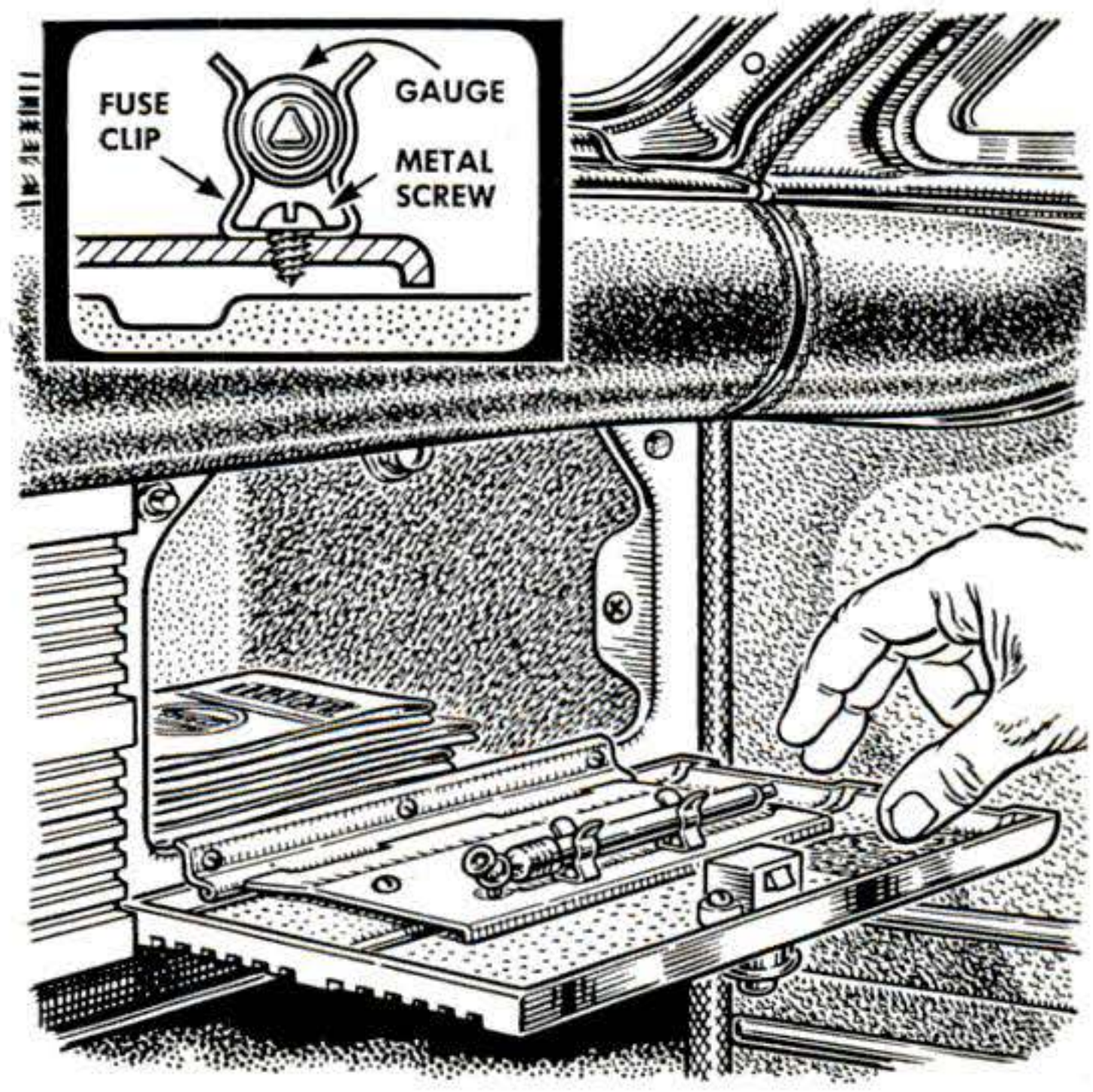
If a door-lock knob breaks and a factory replacement is not available, cut off a short piece of windshield-wiper hose. Loop a piece of copper bell wire through the eye of a dress button about the size of the original knob, push the wire through the hose, turn up the ends and force the assembly over the threaded control rod.



Carpet bunched under the accelerator may make it difficult or impossible to kick down an overdrive transmission from fourth to third to get maximum power. The owner of a car with an automatic transmission may have similar trouble because the pedal is set so low that it bottoms before operating the down-shift switch.



While reboring a cylinder, you can measure the wall with calipers. Put one prong through the water passage and turn up the calipers. Mark the screw setting with a fine pin, take out the calipers, reset the screw and measure between the points.



A tire gauge mounted on the inside of the glove-compartment door with a pair of fuse clips will not get lost among the odds and ends in the compartment. Spring clips suitable for the purpose usually cost only a nickel apiece. Fasten with screws.

Please turn the page for more auto hints.

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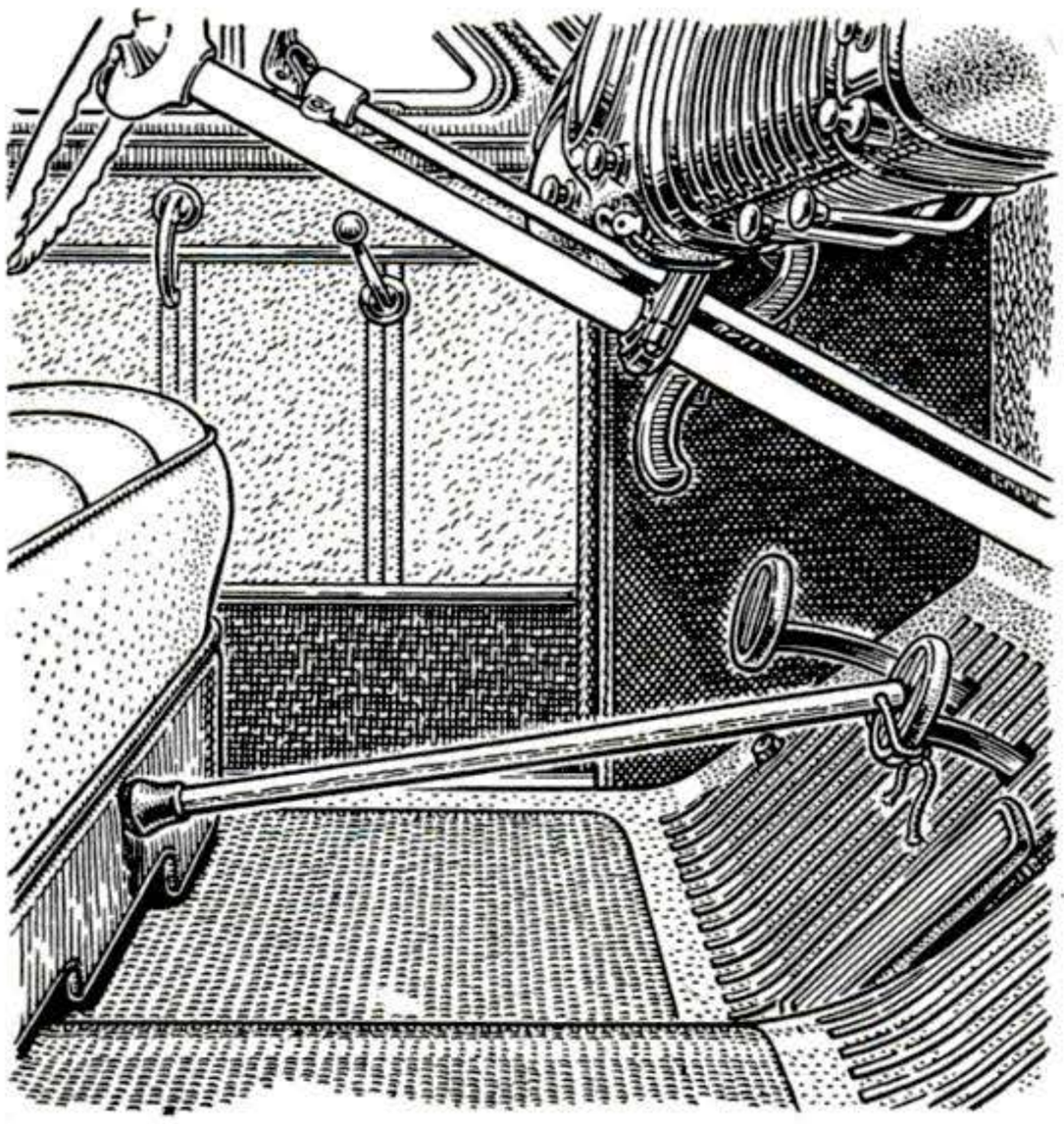
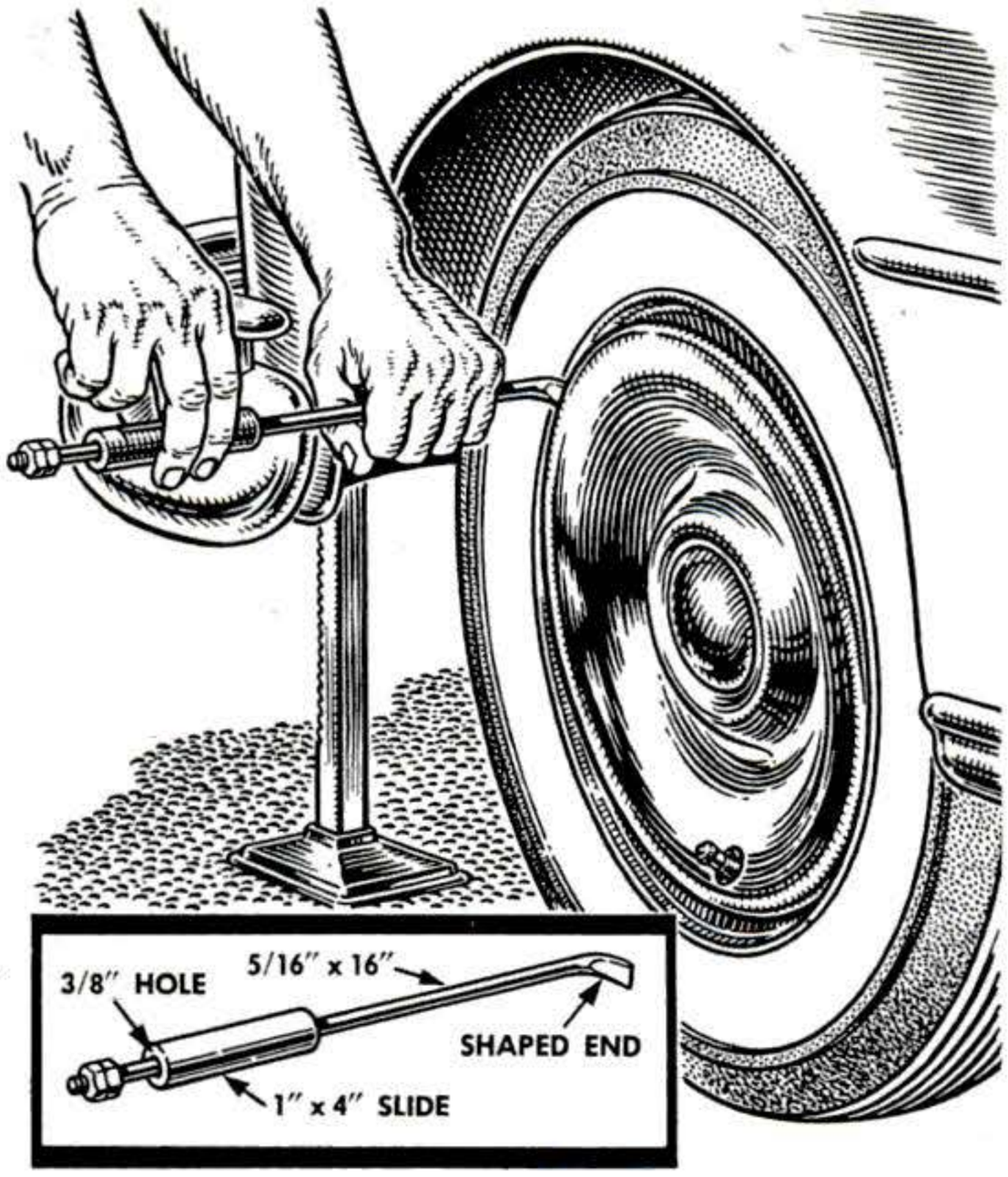
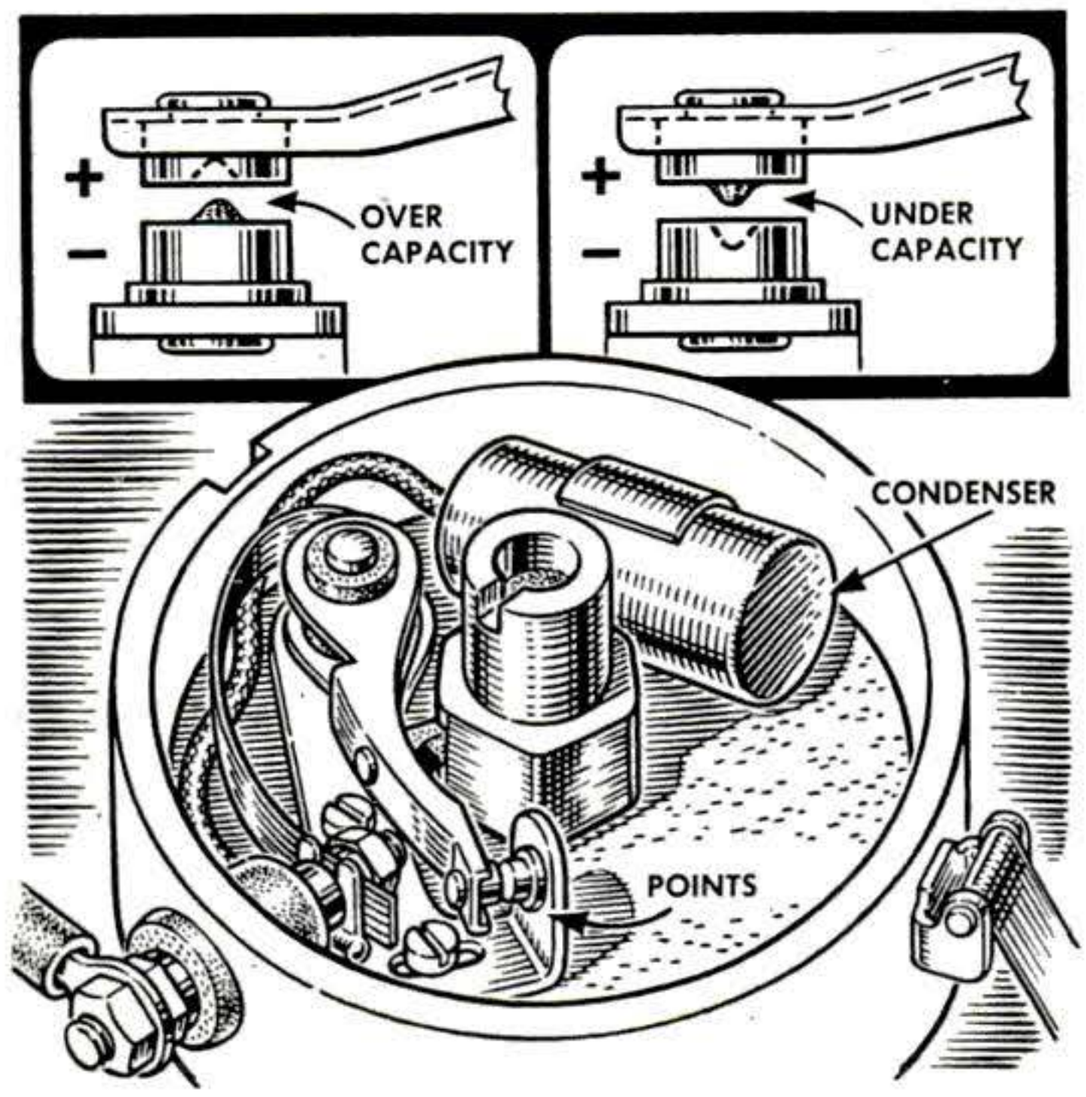
MORE Hints from the Model Garage



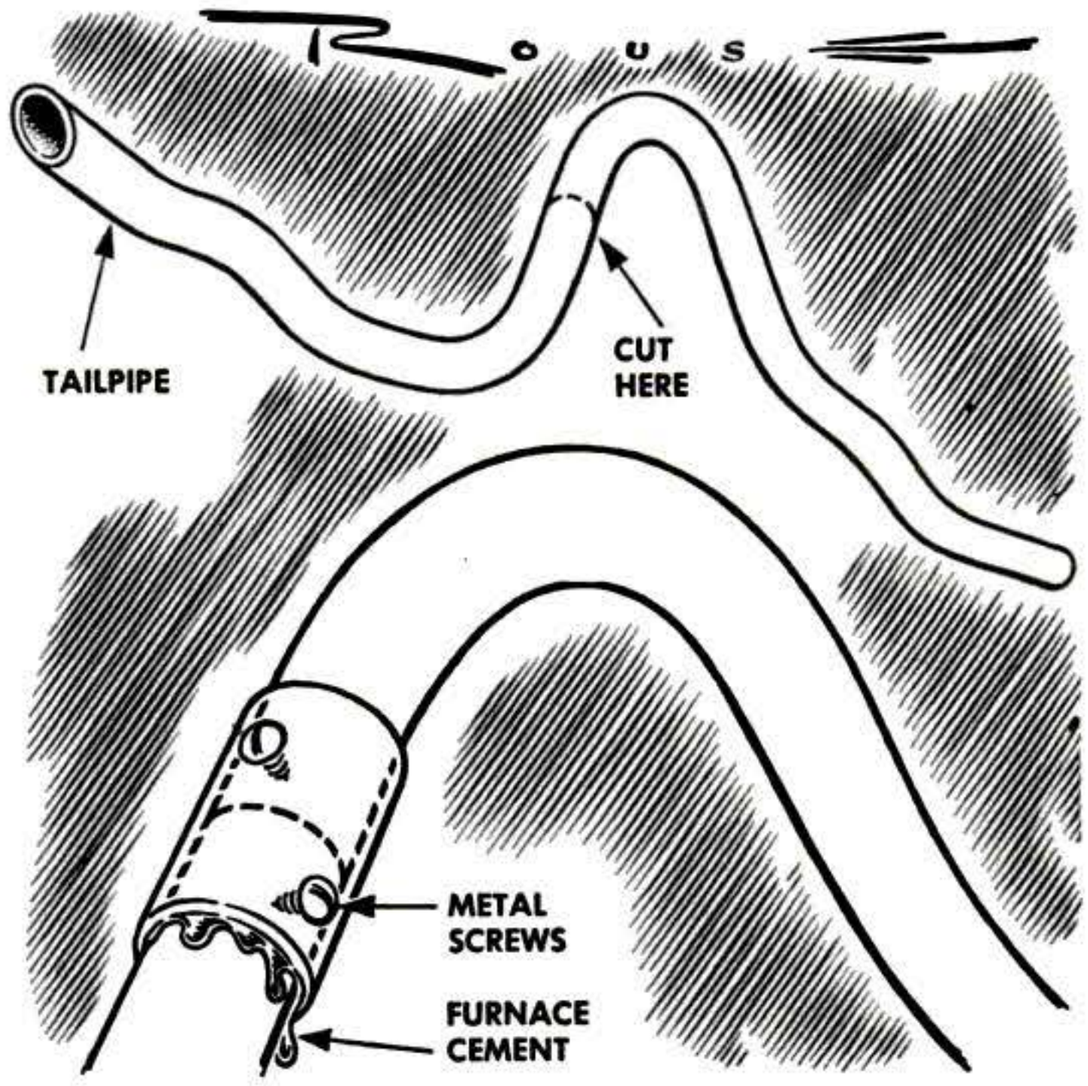
Changing a front tire will be safer and the wheel won't revolve if you first set the brakes with this broomstick arrangement. Cut the stick to the correct length, put a crutch tip on one end and loop cord through a hole in the other. While a front wheel is jacked up you then will have the safety of three locked wheels instead of only two.



A hub cap will come off easier and there will be less chance of marring the wheel paint if you make a tool like this and add it to your car kit. Ramming the slide against the nut while the hook is under the cap rim does the trick. The tool can also be used to remove front-wheel bearing caps that are pressed in place.



Pits in distributor points are a sign that the condenser is of the wrong value. If the positive point pits and the negative one builds up, the condenser is probably over capacity. If it's the other way, the condenser value is too low.



A tailpipe sometimes has so many twists and turns that putting a new one in place becomes a problem. If nothing else works, it may help to saw the pipe in two and later, after the parts are in place, join them with a metal sleeve and furnace cement.

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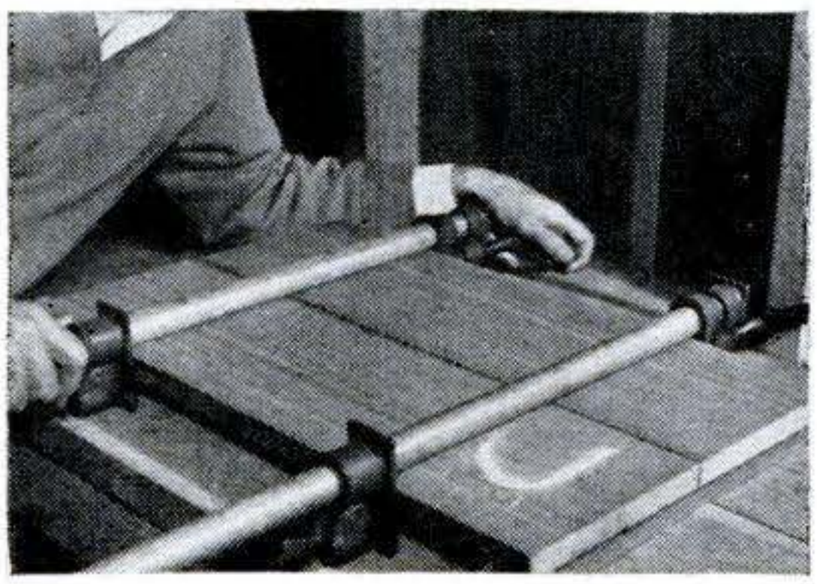
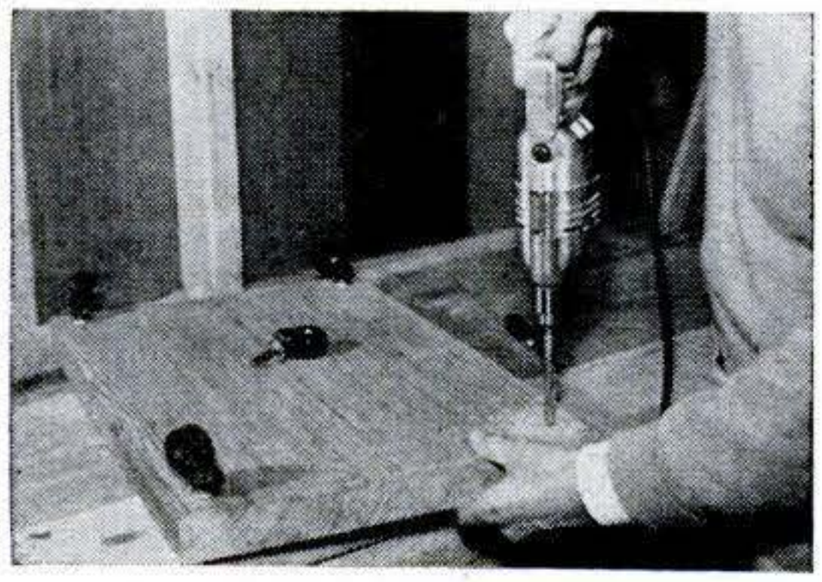
Terrace Wagon Serves Outdoor Meals

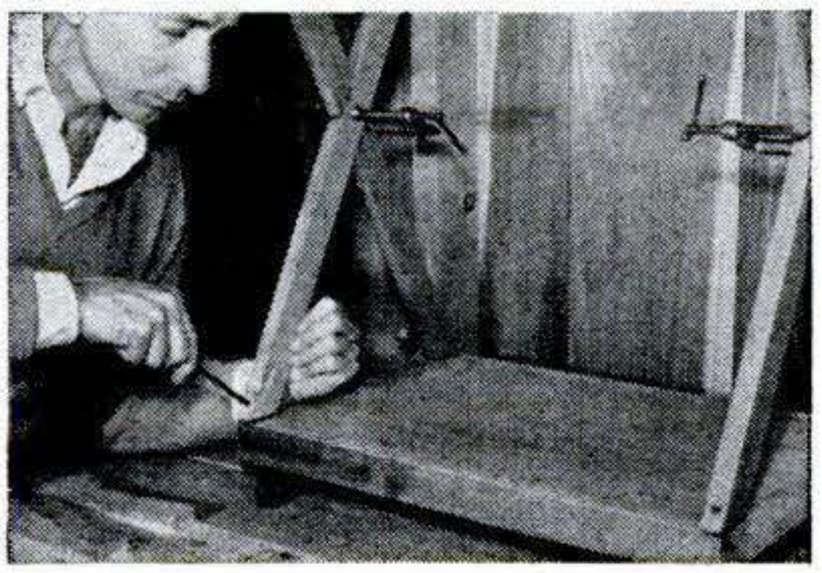
Three spacious shelves let you bring out the whole dinner on wheels. Hand tools make this rugged cart.



1 GLUE UP narrow boards to form the shelves. Follow dimensions for the top and bottom, but take measurements for the center shelf from the table itself.



2 ATTACH CASTERS near corners of bottom shelf. This type fits into ⅜″ blind holes; other types are screw-fastened. Use 2″ rollers with ball-bearing swivels.



3 SIDE BRACES are glued and screwed flush with corners of lower shelf. Use one 1½″ wood screw at each corner and predrill braces to prevent splitting.

ROLLING on ball-bearing casters, this serving cart lets the hostess join the fun of porch or terrace dining. It stands up to outdoor weather but doesn't look out of place indoors.

The wide panels for the shelves are made by edge-gluing redwood boards. Use 1⅝″ stock for the top and bottom, ¾″ for the center shelf and cross braces. Cut an 18½″ by 31″ blank for the top and a 15″ by 22″ for the bottom. Sand them smooth and attach wheels to the lower shelf. If the porch or patio is smooth and hard, large casters will do, but if the

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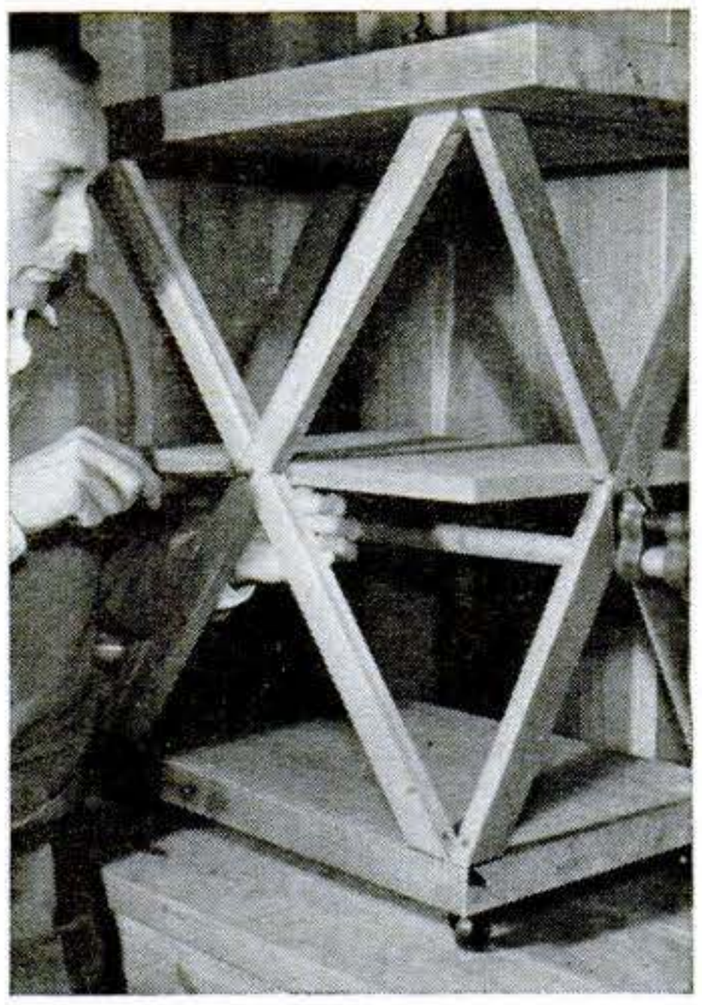
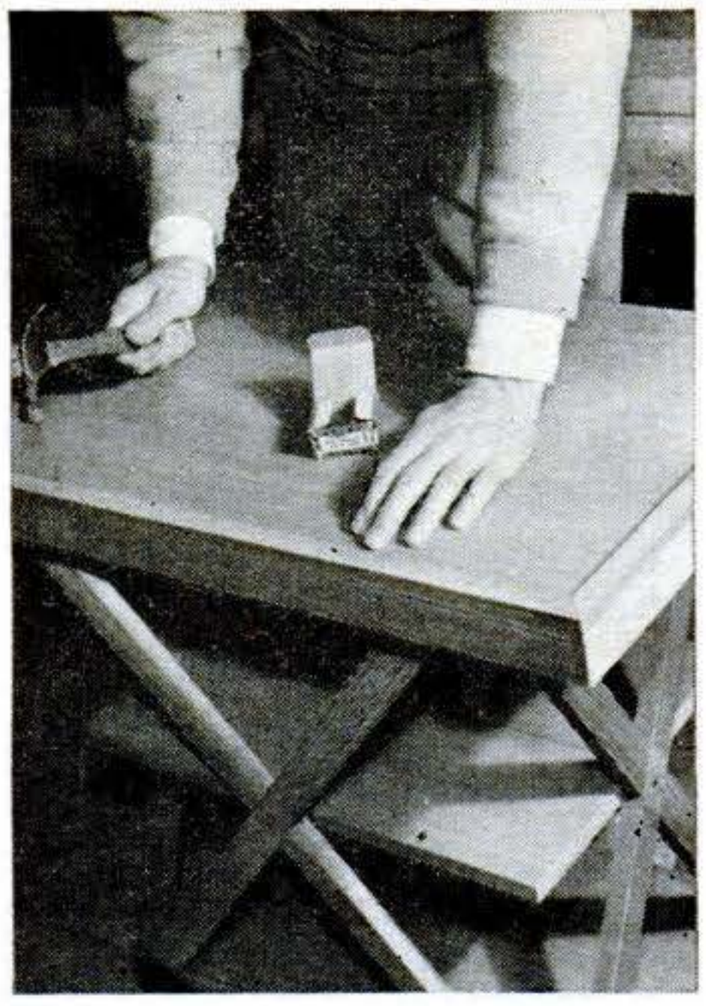
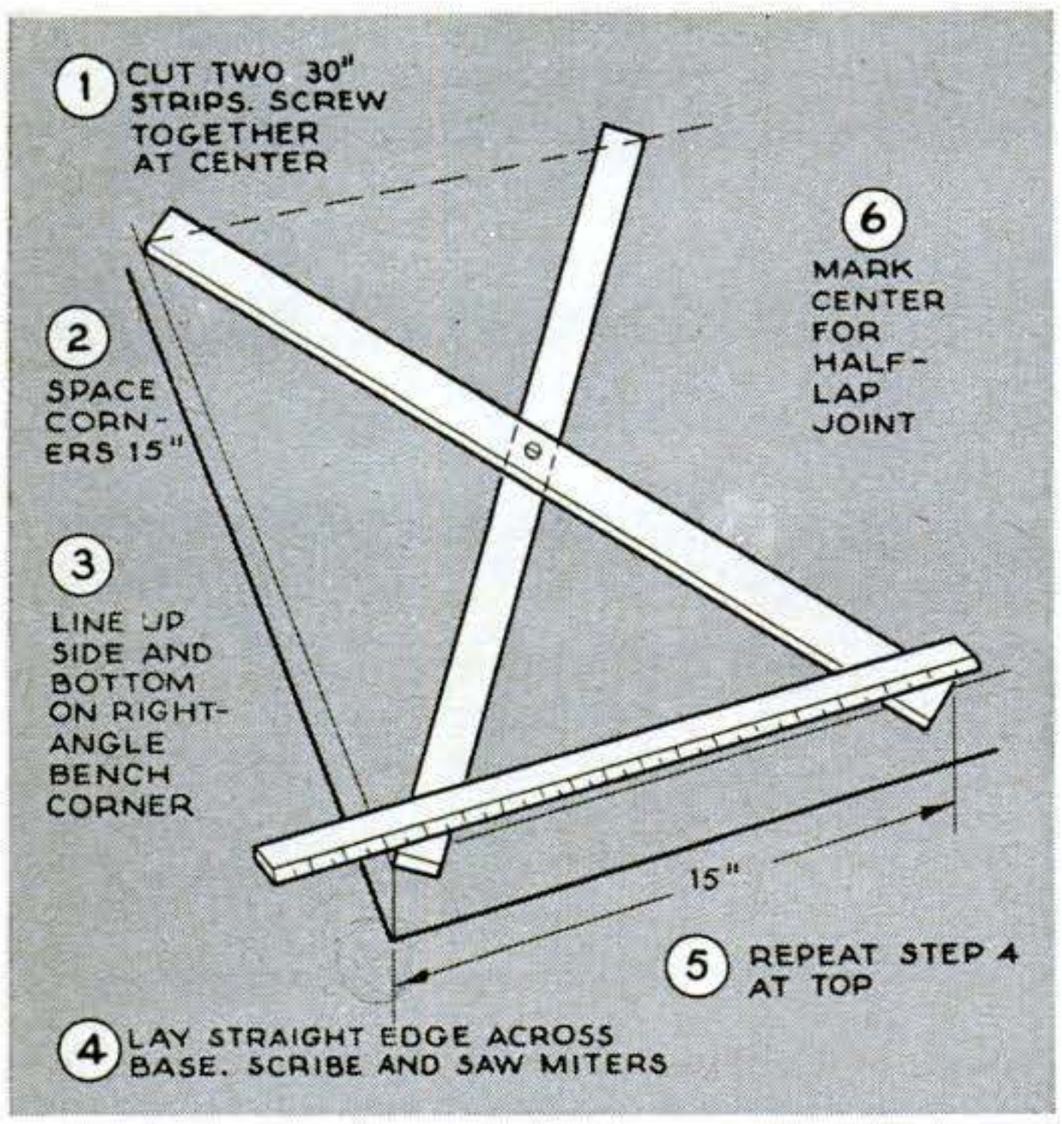
4 TURN TABLE OVER, center braces under top shelf and attach them the same way. Note glued half-lap joint where crosspieces meet.



5 MIDDLE SHELF, cut to fit, is glued and screwed to braces. Braces should cross at same height, but level the shelf before you screw it on.



6 RAIL, bradded to top, keeps things from sliding off when table is being moved. Enclose sides and back only, mitering corners.



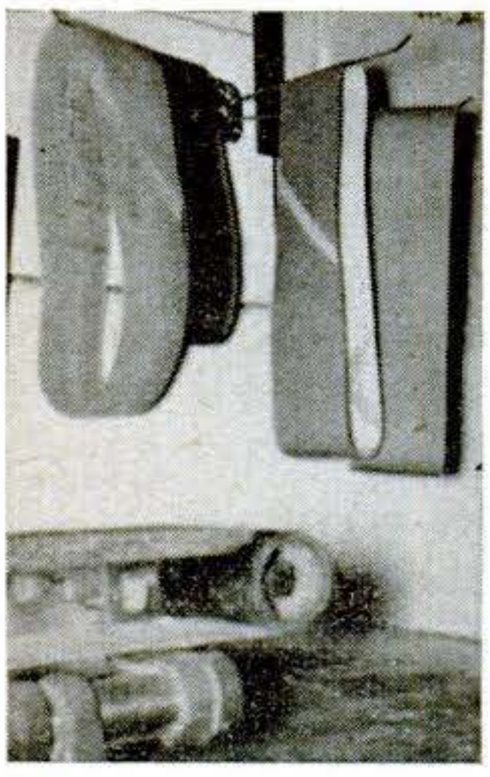
cart is to be rolled on the lawn, better use 4″ or larger rubber wheels.

Next, cut four ¾″ by 1½″ by 30″ pieces for the side braces. Screw two of them together at their centers and mark off the corner miters and the half-lap joint as shown at the left. When you have trimmed the corners and cut the lap, reassemble the brace and use it to mark the second one.

Glue and screw the side braces to the lower shelf so all four feet square up with the corners. Turn the assembly upside down and center the braces on the upper shelf.

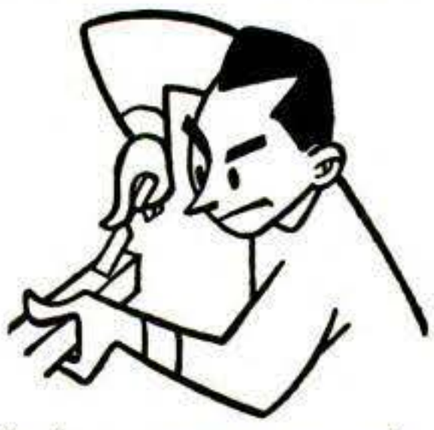
Make a brace for the back from 32″ pieces and fit it between the side braces. Cut the center shelf to fit between the legs. Sand the cart, rub it with linseed oil, and finish it with a coat of hard wax.—*John Rogers, Dallas.*

Towel Rack Holds Sander Belts



A DIME-STORE towel rack on my shop wall holds the belts for my portable and bench sanders. The rack keeps the belts straight, stores them near my work and lets me quickly choose the size and grit I need for any job.—*E. P. Alexander Jr., Plymouth, Mass.*

Workshop Wisdom



His chisel was dull, but more muscle
Would get the job done, thought
Joe Fussel.
The edge didn't cut
Where he meant it to, but
Instead took a slice out of Fussel.

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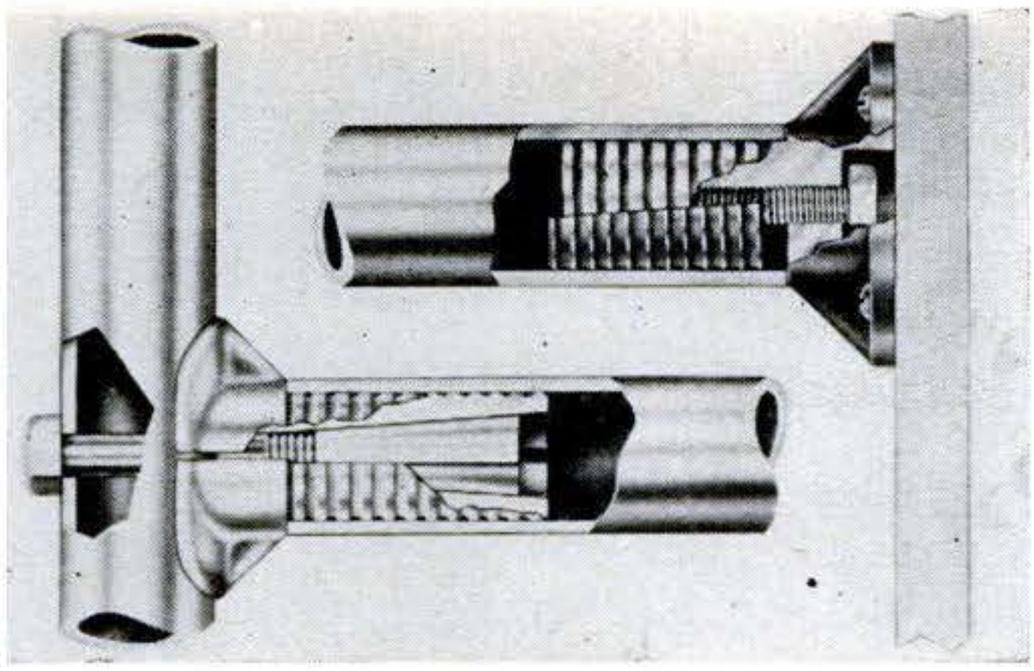
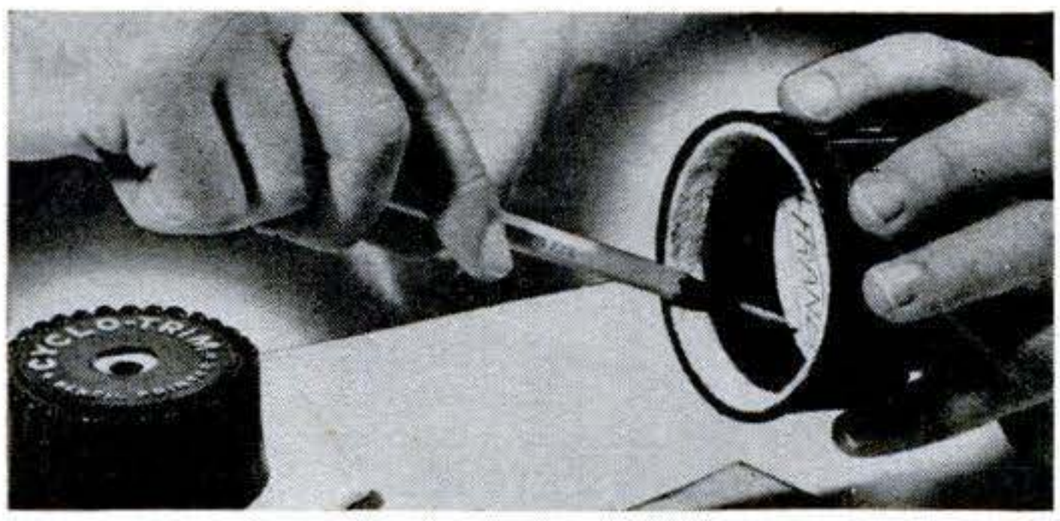


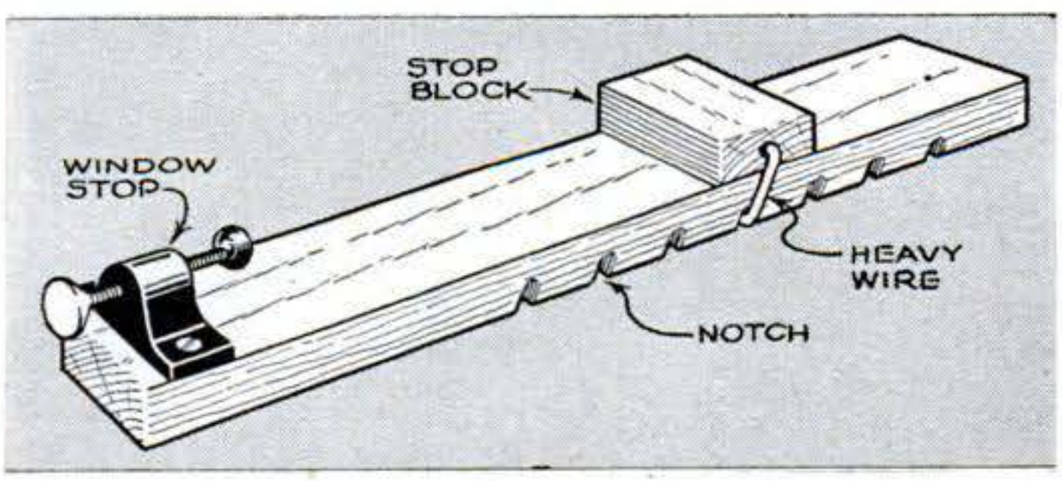
Coupler Can Be Re-used

As THE connecting bolt in this cast-iron tubing coupler is screwed tighter, two wedge-shaped metal pieces are pressed tightly against the inside of the tube. Turning the bolt counterclockwise releases the wedges and lets the coupler slip out of the tube. Two models are made by the Belvidere Aluminum Co., Rockford, Ill., to join tubing and to attach tubing to a flat surface.



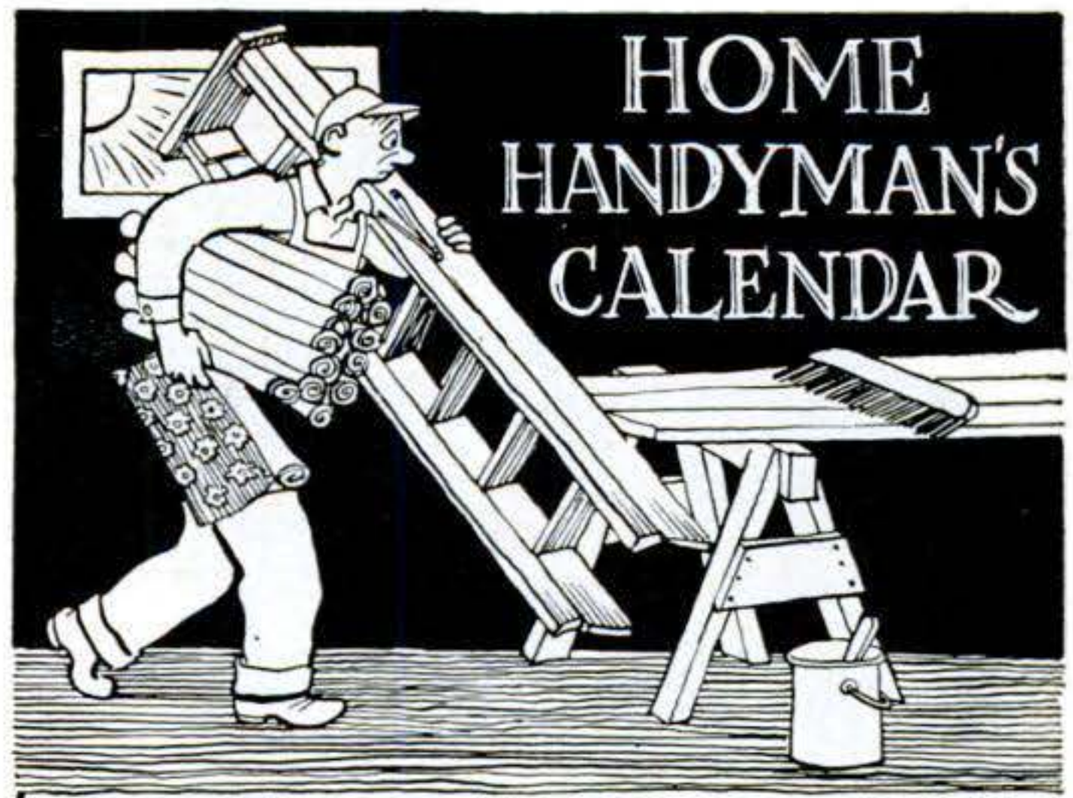
Sharpener for Draftsmen

A SILICON CARBIDE abrasive surface on the inside of this cylindrical holder quickly gives pencils a sharp point. It also dresses divider points. After pointing, pencils can be cleaned by wiping them across a strip of felt that is glued inside the cylinder. Franz Patent Laboratories, Oakland, Calif., makes the sharpener.



Window Stop Makes Clamp

CLAMPS like this are inexpensive to make and very useful for clamping broad surfaces. Use several of them side by side. The stop block can be adjusted to work of different widths by shifting the wire loop.



July brings hot, sunny afternoons when it's more fun to loaf in the shade or work indoors. And, with proper planning, you can do just that. This is a good time to do interior painting and papering. Paint should last three to five years in cities, longer in suburbs; but you don't have to do all the painting in one season.

- Your cellar may be the coolest spot in the house this month and a pleasant place to work. Take advantage of that natural air conditioning and July's dry weather to install a sump pump and drains. If condensation in warm, humid weather makes your cold-water pipes sweat and drip, here's your chance to eliminate the trouble by covering pipes with insulation.

- Check your refrigerator and freezer mechanisms now, particularly belts and motors. Oil all motors and fans. Have a serviceman replenish gas supply of freezing units if bolts around compressor gaskets are loose.
- This is a good time, too, to lay floors of linoleum or asphalt tile. And be sure to check furniture to see that all legs are resting on gliders that won't injure floors.

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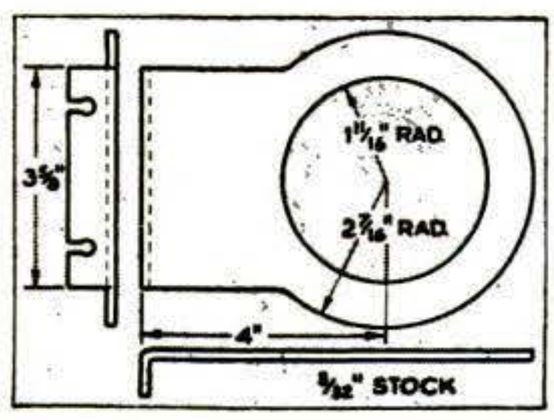
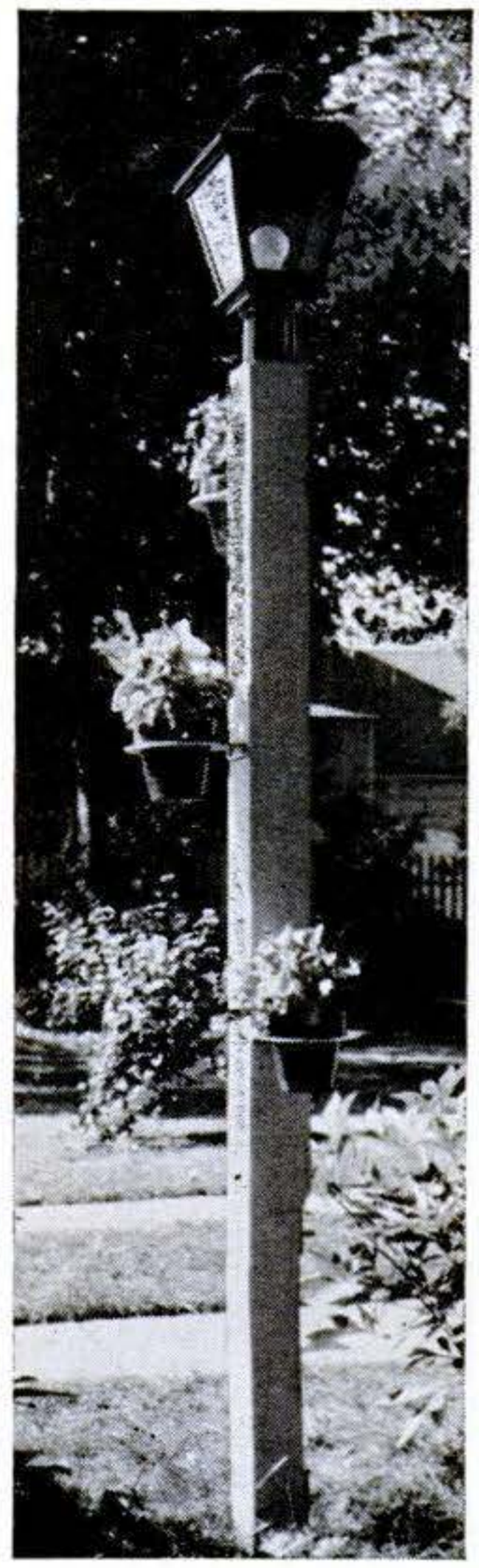
Tin-Snip Guard Saves Fingers

A SIMPLE leather guard on metal shears will save your knuckles from scratches and cuts. Use a piece of leather about ⅛″ thick. Shoe-repair shops usually have such scraps. Fasten the guard to the lower arm of the shears with staples or stiff wire. Clinch the staples or wire with pliers. You can make a similar guard for the upper part of the shears, but it isn't necessary, since you can usually bend waste metal away from your thumb as the cut progresses.

Brackets Hold Flowerpots

ALL summer these brackets hold flowerpots to decorate the lamppost in my front yard. When cold weather comes, it's a simple matter to slip the brackets off the mounting screws and hook them over other screws in the kitchen. I used a bandsaw to shape the brackets of 3/32″ aluminum. The openings for the pots were made with a fly cutter, and the slotted holes with a drill and file. I painted the pots a bright red.—*W. M. Hine, Lynbrook, N.Y.*



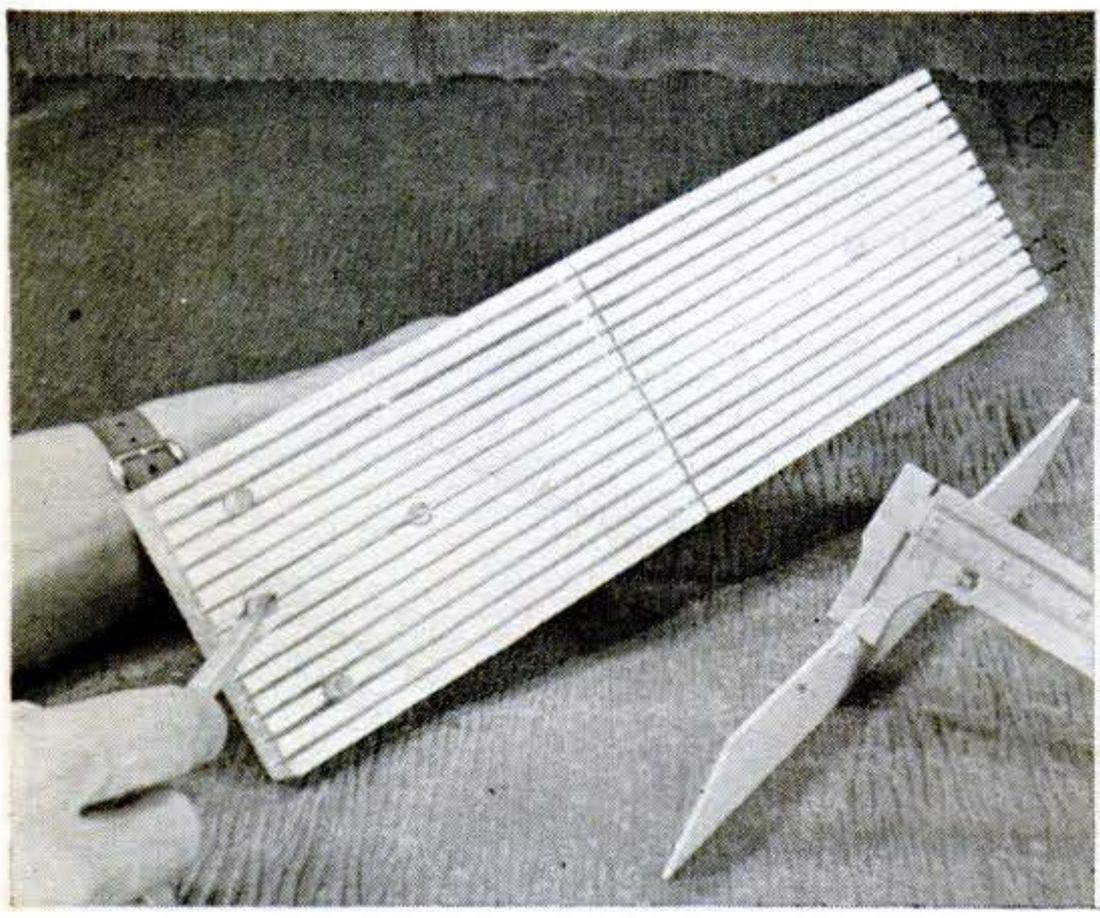


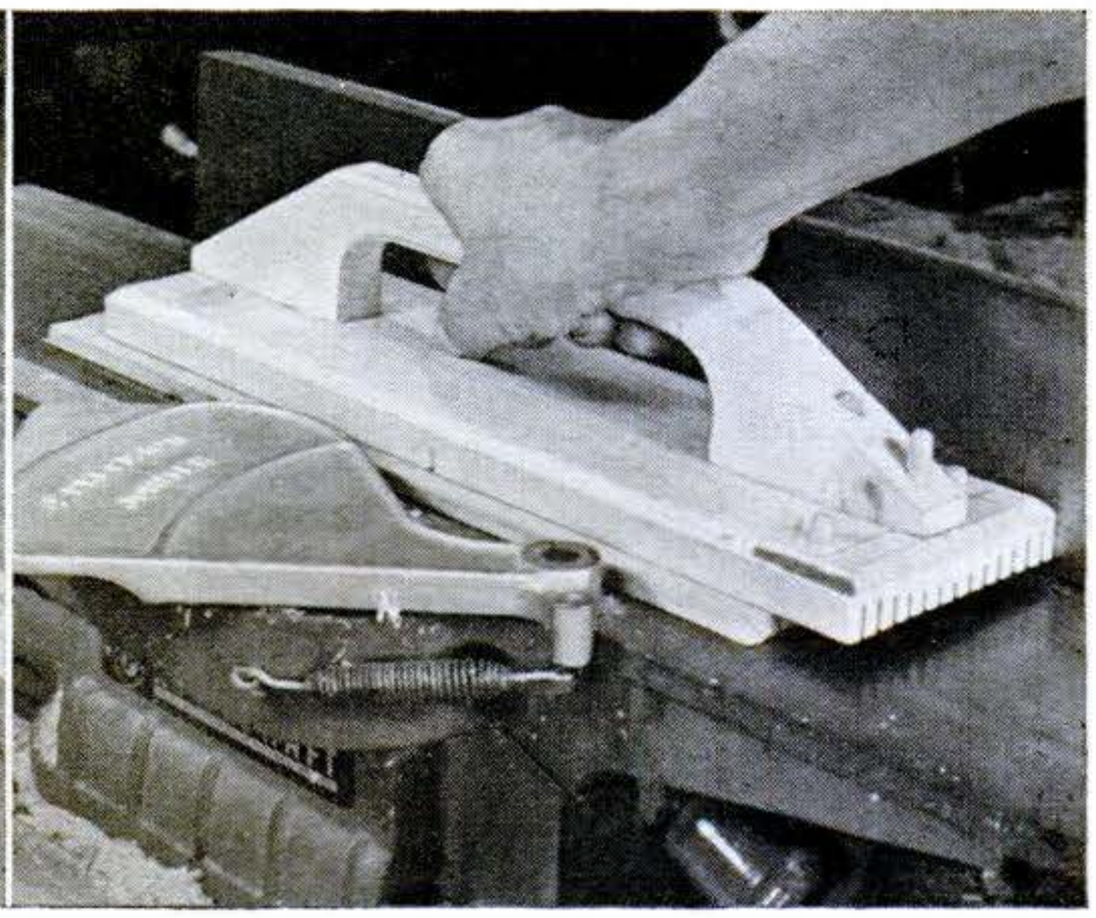
Play It Safe: Use a Pusher on Your Jointer or Sander

SURFACING a thin board on a jointer or belt sander can be a dangerous job—even for an experienced craftsman. It's best to use a pusher that keeps your fingers well away from the knives or belt.

This pusher applies even pressure on the work and will handle stock as thin as 1/32″. Make it of ¾″ wood about 4″ by 6″ by 12″, depending on the size of the jointer. Cut saw kerfs in the underside to minimize warping. Glue and dowel a handle to the top side.

Three ¼″ dowels near the rear of the pusher move the work over the knives. Don't glue these dowels in place. Then they can be tapped up or down to suit the thickness of the work. Use the center dowel alone for narrow work, pushing the other two up.—*H. L. Truchelut, Atlanta.*





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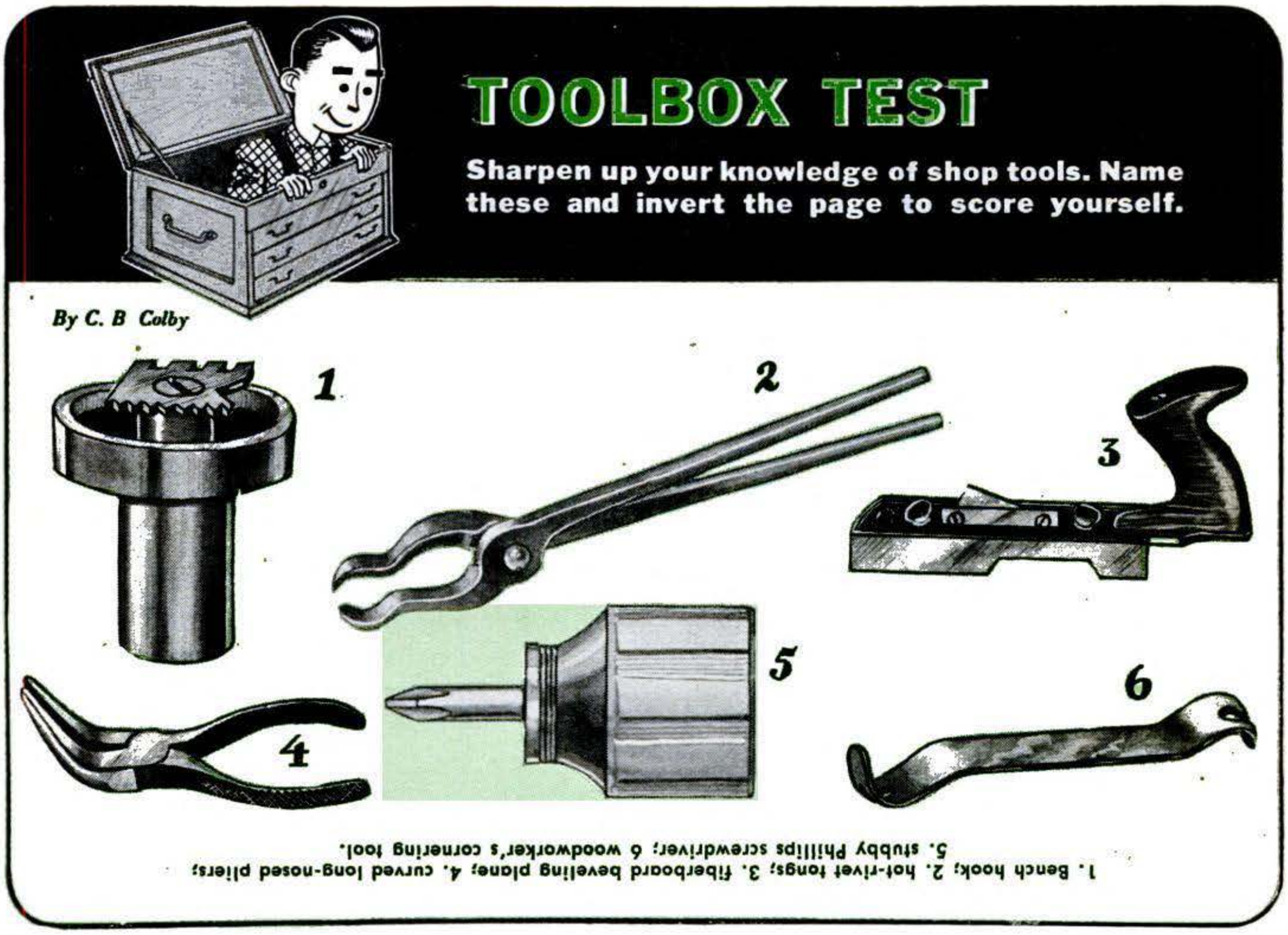
Picnic Table Is Carrying Case for Charcoal Grill

WHEN we go to the beach or on a picnic, this flat case carries the charcoal grill and then unfolds to form a sturdy table that is just the right height to eat from when you're sitting on the sand.

Dimensions, of course, will have to suit the particular charcoal grill. I built this one of ½" and 1" stock with the ¼" hardboard table top rabbeted into the framing pieces. The legs are 1" pieces hinged inside the frame. The case is finished with luggage corners, and luggage snaps hold the halves together for carrying.—*Norman C. Branch, W. Hartford, Conn.*



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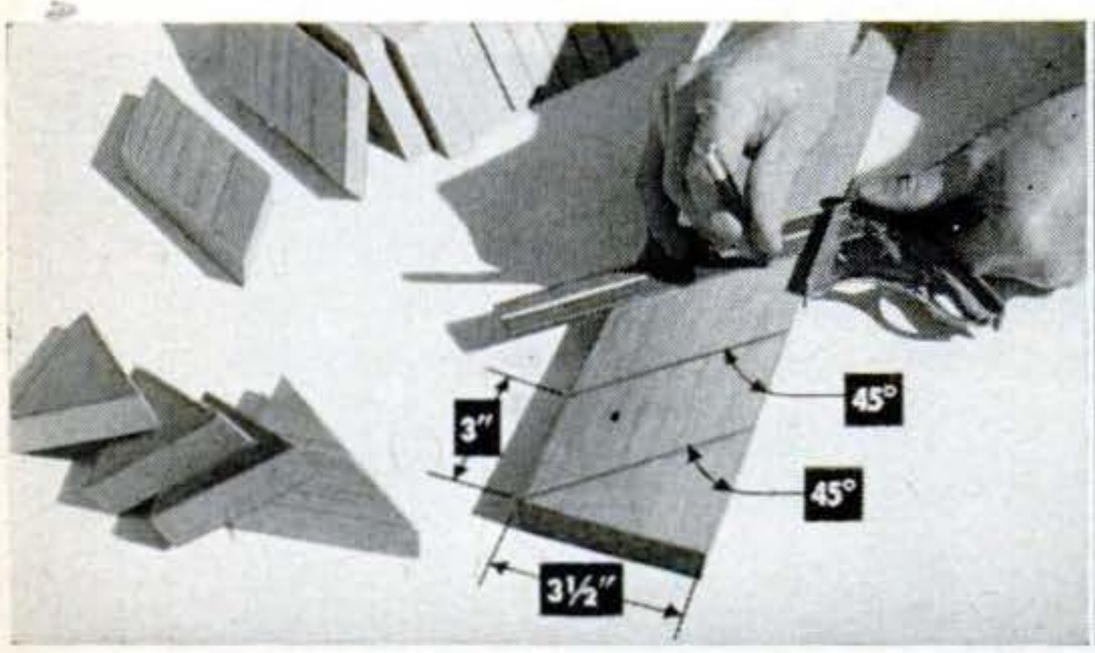
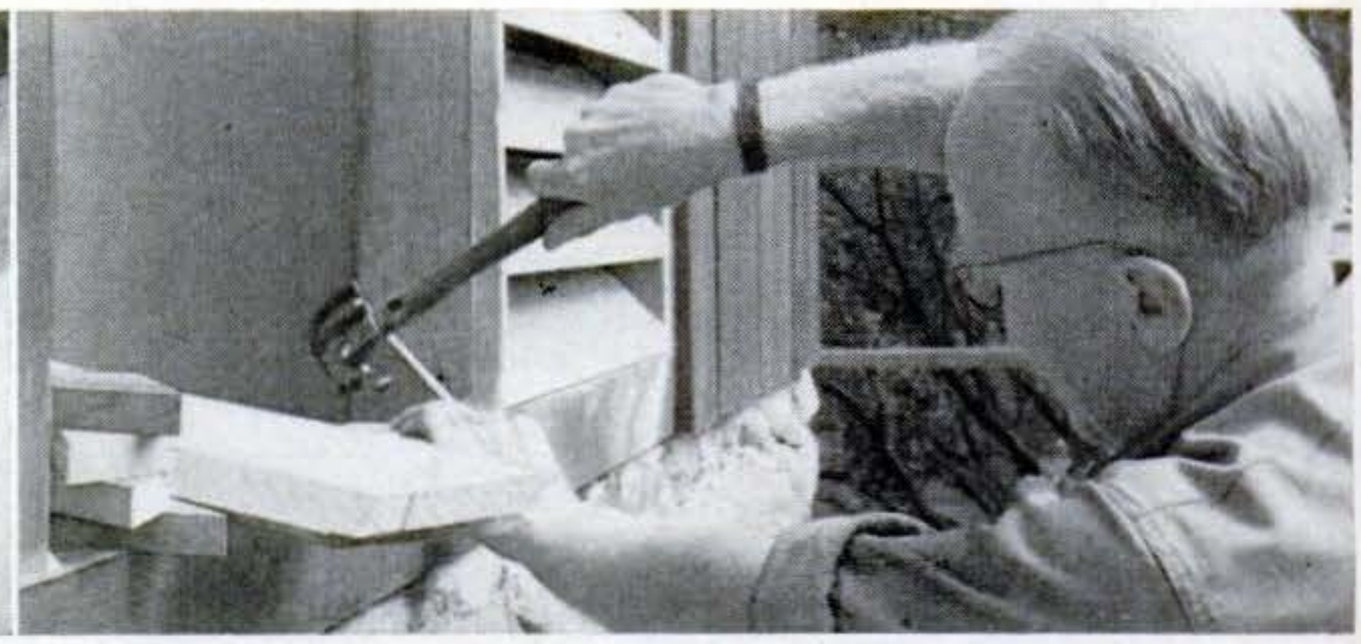
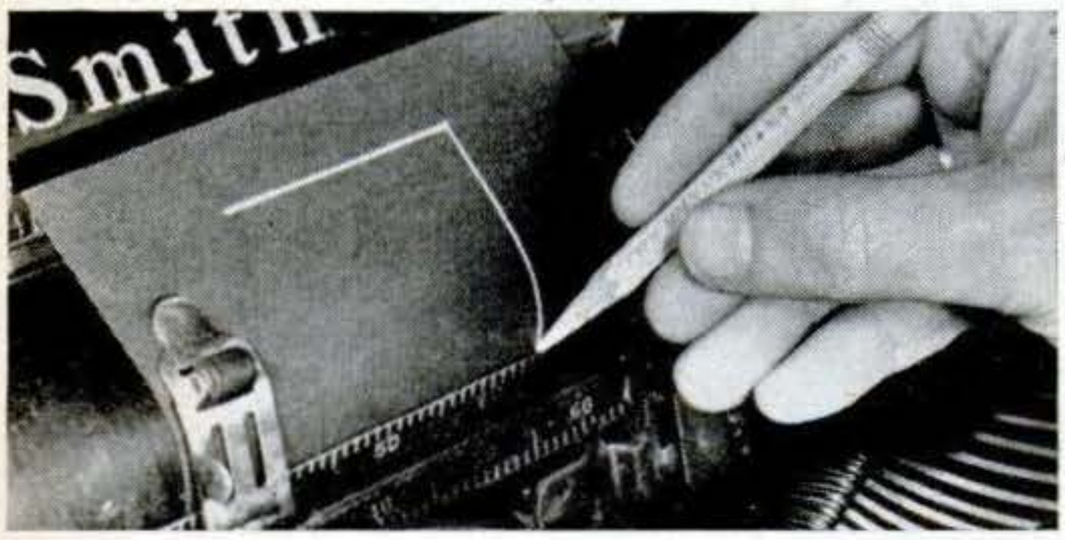


PRELIMINARIES. Cut spacer blocks from stock wide enough to match wall thickness. Louver boards can be 6″ or 8″ wide, beveled or not.



TRIANGULAR BLOCKS. These are right-angle blocks the same width as wall thickness. Nail one on each side at bottom of opening.

Photo Masks Can Be Laid Out Accurately on a Typewriter



BLACK paper masks for contact printing or enlarging can be drawn quickly and accurately on a typewriter. Place the paper in the machine and hold a pencil firmly on the platen scale, as at left. Move the carriage to make a horizontal line and turn the platen knob to make a vertical line. Then cut out along the lines.—*John J. Rea, Urbana, Ill.*

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We're in Love with Louvers

You save time, work and money by making windows just to look through and using other openings for ventilation.

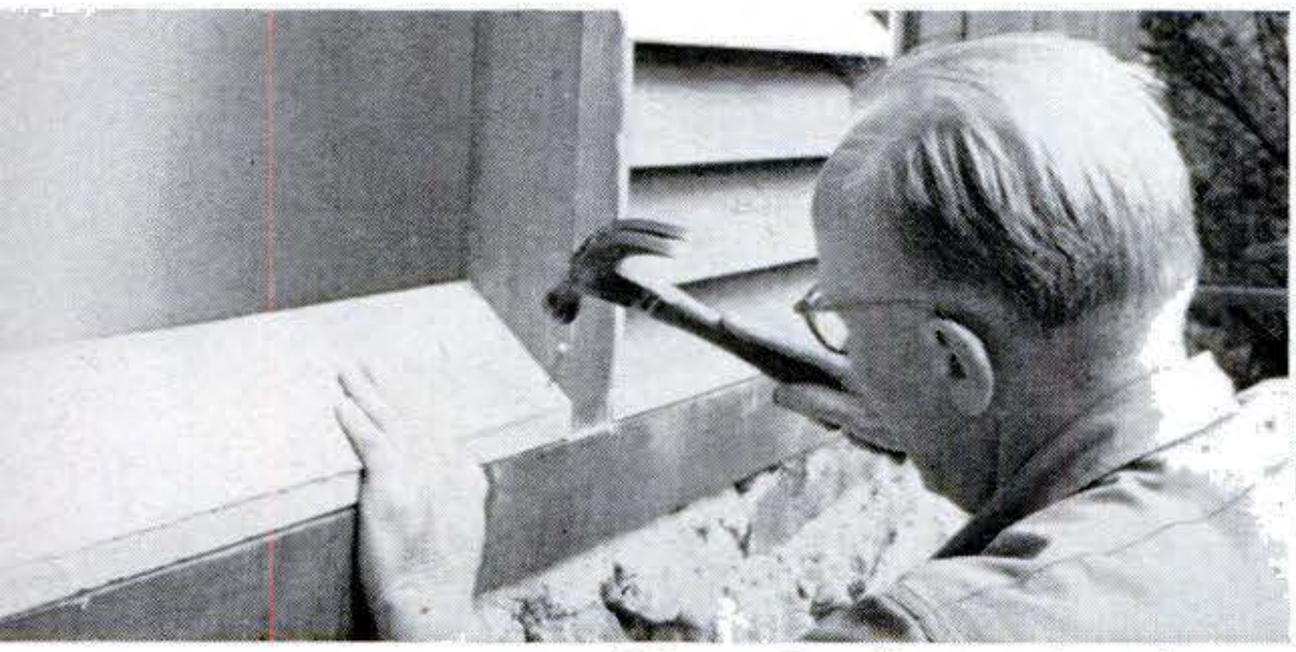
HINGED DOORS. Insect screening covers inside of louver opening. Hinged door, held in open position by chain, deflects drafts upward.

LOUVERS—an old, old architectural gimmick—are coming into their own again. We have built three houses with louver construction and we will never build another home without them. You often find them today on modern homes. They are so easy and quick to install and the ventilation they give is so efficient that you should remember them when you are doing a remodeling job or maybe building a summer cabin.

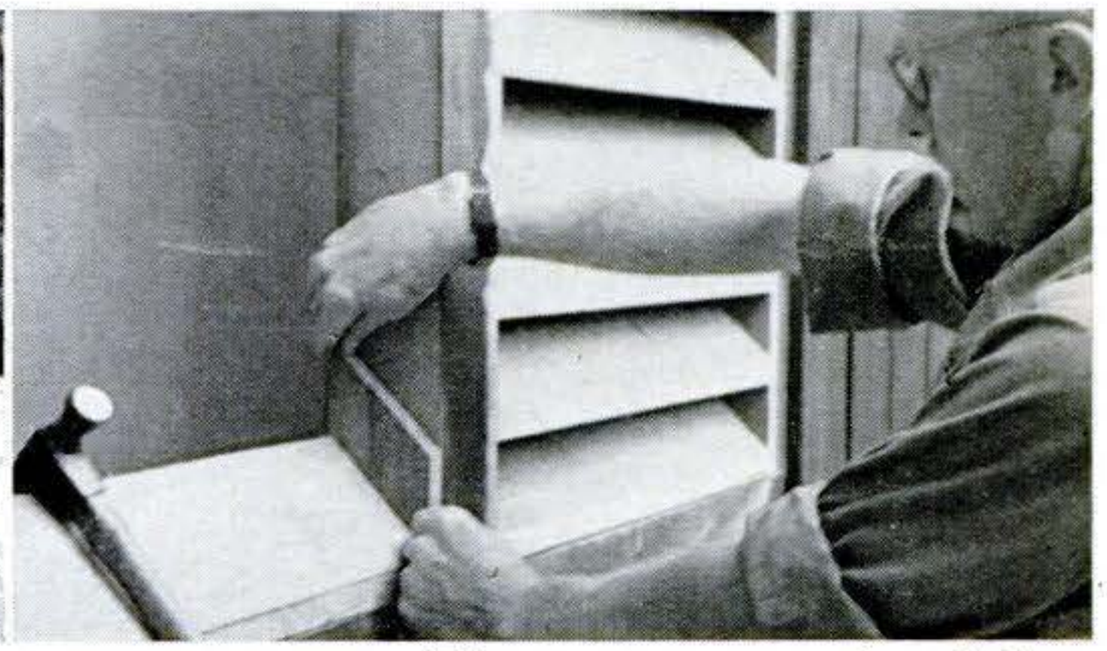
With louvers, your window-construction job is a cinch. You just use fixed windows—set right into the building framing. No sliding or hinged sash, no window screens or hardware are needed.

Construction. If you can nail two boards together, you can install louvers. Fixed louvers—like those shown in the photos—are only a series of identical pieces that cut readily from stock lumber. After the pieces are sawed to size, you just nail one piece on top of the other. You have no spacing or fitting problems.

Lumber sizes. When the opening calls for boards no more than 3′ long, nominal 1″ stock works well. With lengths greater than 3′, there is danger of warping. Better use full 1″ or even nominal 2″ lumber.—*Paul Corey and Darrell Huff, Sonoma, Calif.*



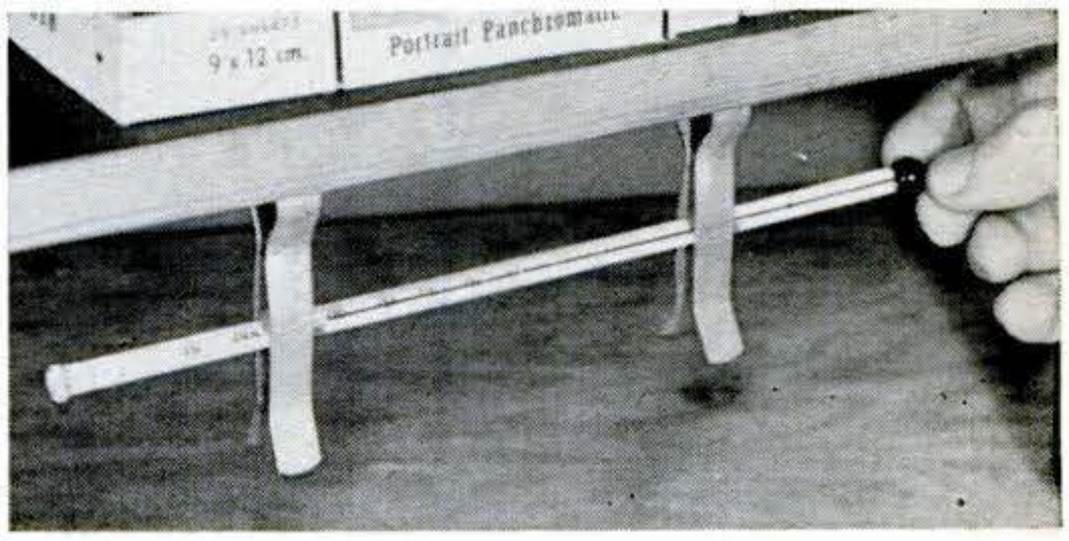
LOUVER BOARDS. Place first louver board on right-angle blocks. Toenail board to frame. Driving nails into blocks might split them.



SPACER BLOCKS. These go on top of each louver board. Nail them to frame of opening. Add boards and blocks until job is finished.

Aluminum Clothespins Form Rack for Storing Small Tools

A STIRRING-ROD thermometer can be safely and conveniently stored beneath a darkroom shelf with two aluminum clothespins, as shown in photograph at right. Drill a small hole in the tops of the pins and attach them to the shelf with wood screws. You also can store a ruler or other small tools in your shop with the same kind of clothespins.



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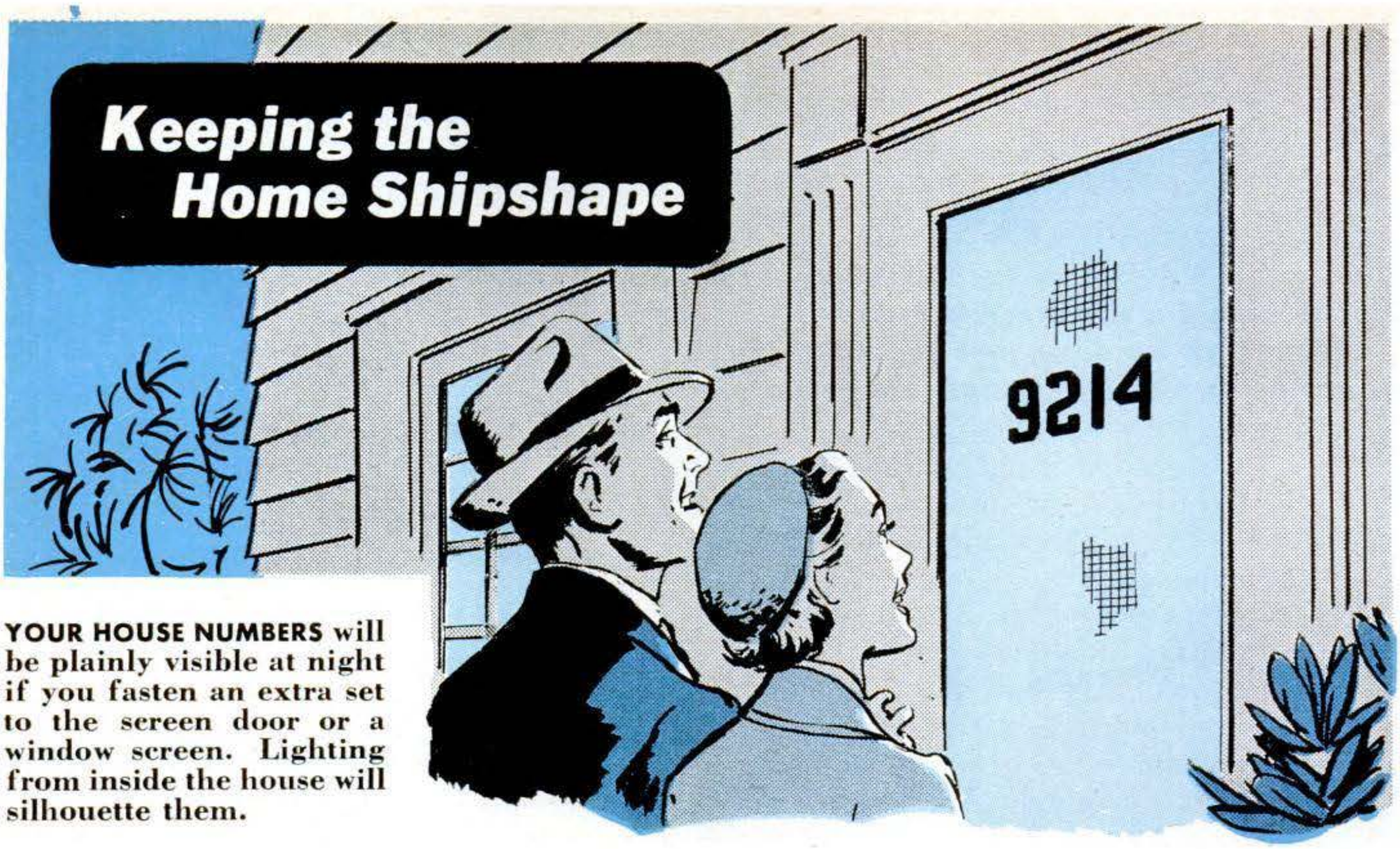
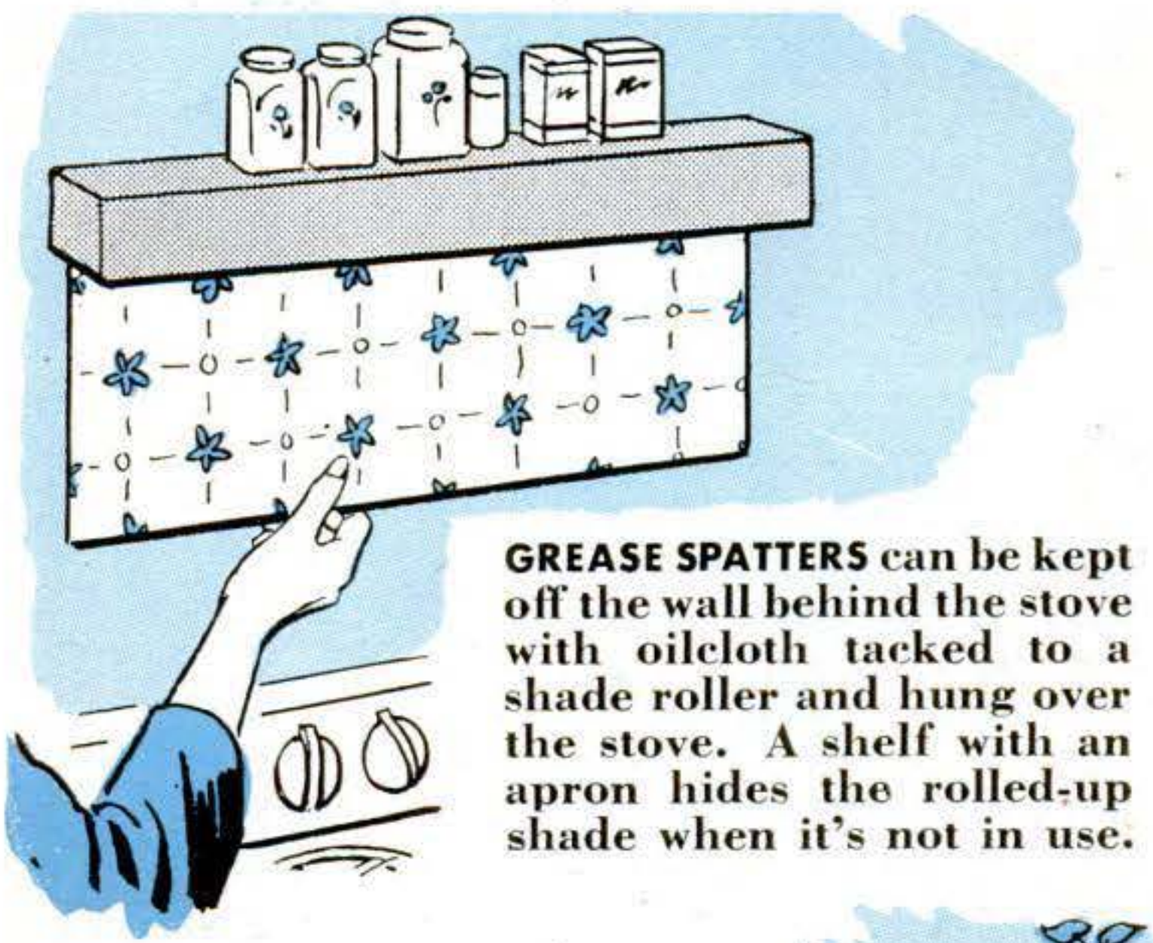
Keeping the Home Shipshape

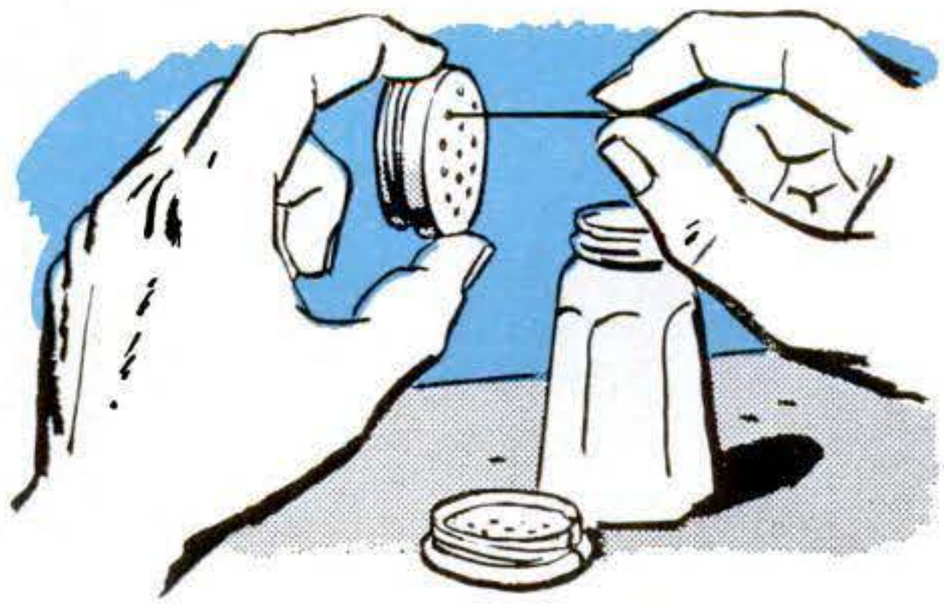


YOUR HOUSE NUMBERS will be plainly visible at night if you fasten an extra set to the screen door or a window screen. Lighting from inside the house will silhouette them.



GREASE SPATTERS can be kept off the wall behind the stove with oilcloth tacked to a shade roller and hung over the stove. A shelf with an apron hides the rolled-up shade when it's not in use.

SALT-SHAKER TOPS of silver are less liable to discolor if coated on the inside with paraffin. Pour melted wax into the tops and when it has hardened prick through the holes with a pin.



KNEELING PADS for gardening can be cut from inner tubing. Cut two pieces the desired length. Slit them open at the back, leaving two uncut bands at top and bottom to hold the pads in place on the legs.

A COFFEE POT makes a paint container with a convenient handle. It's easier to hold than a can, and your hands stay clean even if paint runs down the sides.

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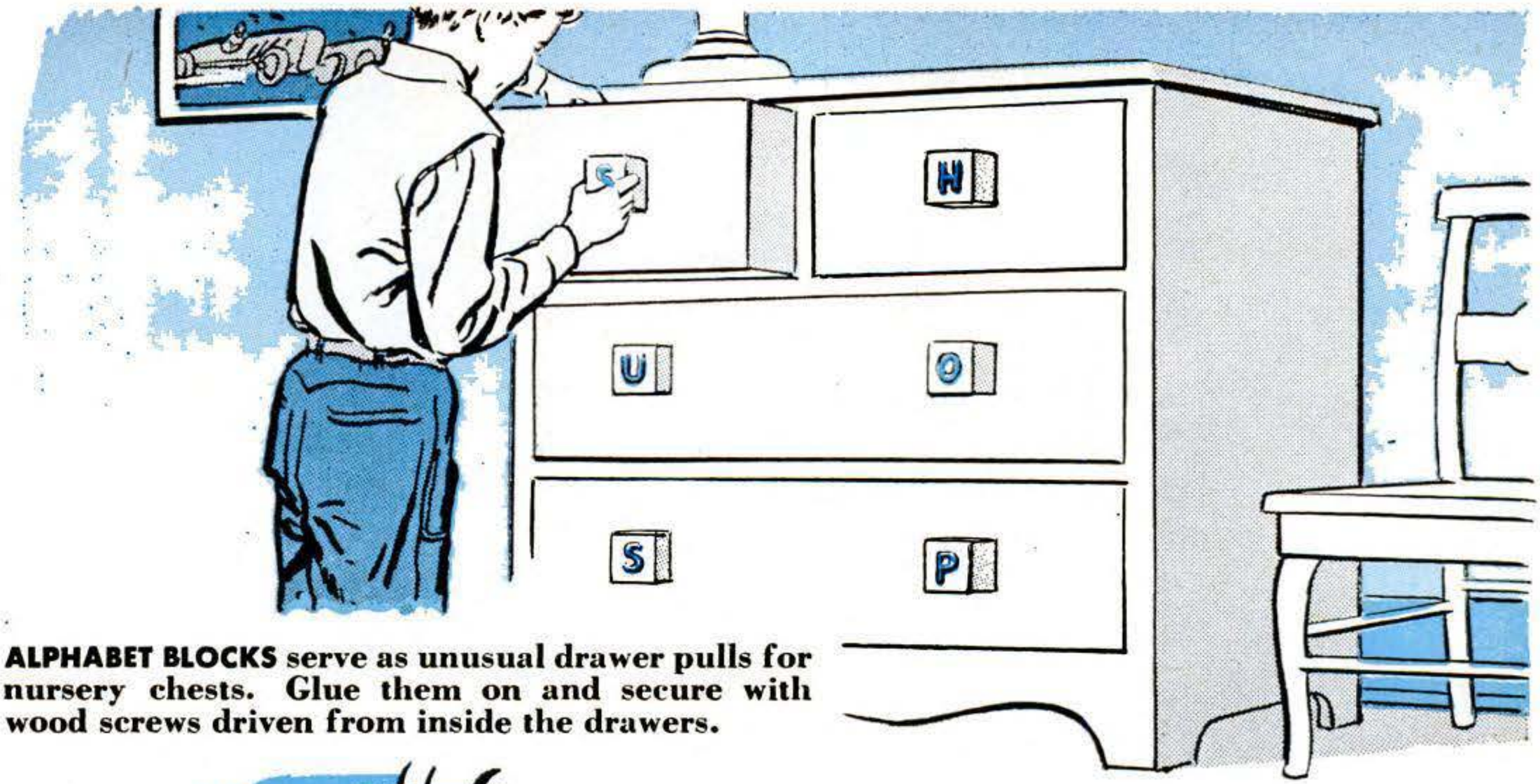
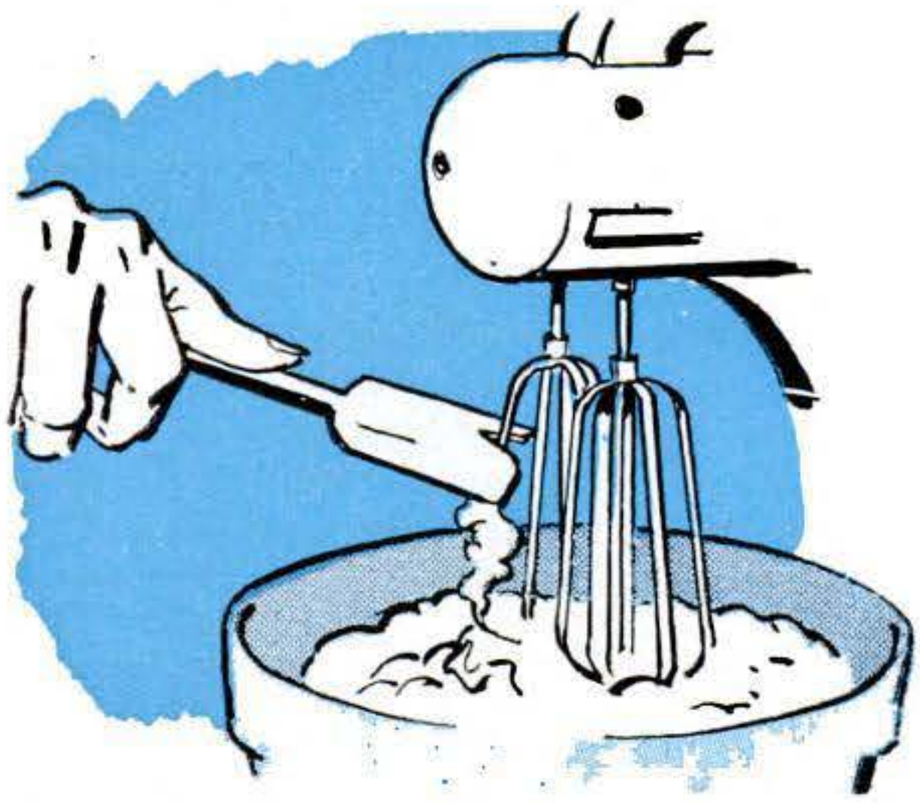
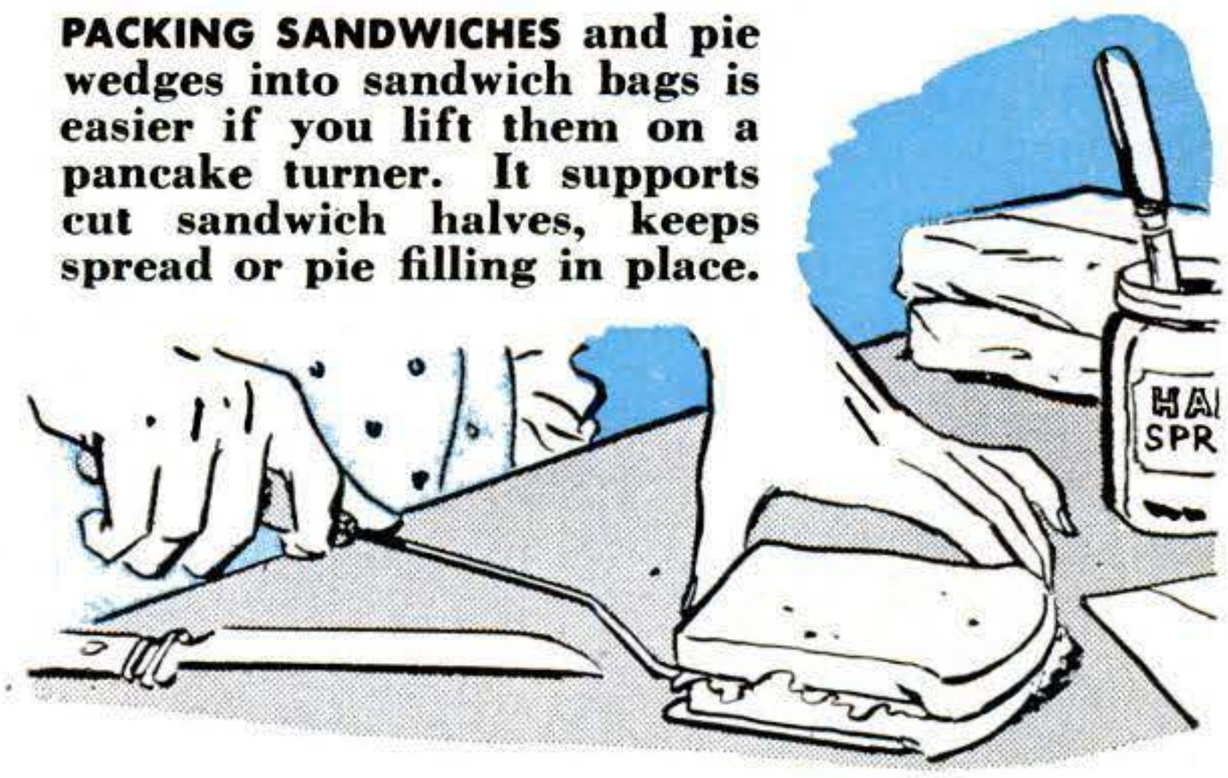


ALPHABET BLOCKS serve as unusual drawer pulls for nursery chests. Glue them on and secure with wood screws driven from inside the drawers.



GETTING ALL THE BATTER from the mixer blades is easy if you use a bowl scraper with a V-shaped slot cut in it.



PACKING SANDWICHES and pie wedges into sandwich bags is easier if you lift them on a pancake turner. It supports cut sandwich halves, keeps spread or pie filling in place.

A GARDEN BASKET like this is handy for gathering cut flowers. Just poke a cane through a wicker basket. A wooden collar on the cane will keep it from slipping down.

TABLE LEAVES can be stored neatly on the back of a door. Two cleats spaced to take the leaves are screwed to the door. Turn buttons on the ends of the cleats keep the leaves from sliding out.

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PICTURE MAKING BEGINS when cooking ends in this model kitchen. Built-in features enable photographer to get going without wearisome preparation. Counter top resists chemicals.

Kitchen Doubles as Photo Darkroom

Built-ins ease the photographer's job without disturbing the cook.

PLANNING DESK stores essential photo equipment and leaves drawer at top free for wife's household records. For darkroom session, the photographer can quickly set up an enlarger on desk. During day, wife can use it as extra work surface or as a desk. Desk shown was made by placing plywood on top of standard base cabinet. For finished appearance, top could have linoleum or plastic covering and molding on edge. Angle brackets fasten leg to plywood.

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MANY an amateur photographer still is plagued by the housing shortage. Even though he lives in a brand-new home, chances are it is the expansion-attic, 1½-story type built on a concrete slab, and he has no convenient place to set up a darkroom.

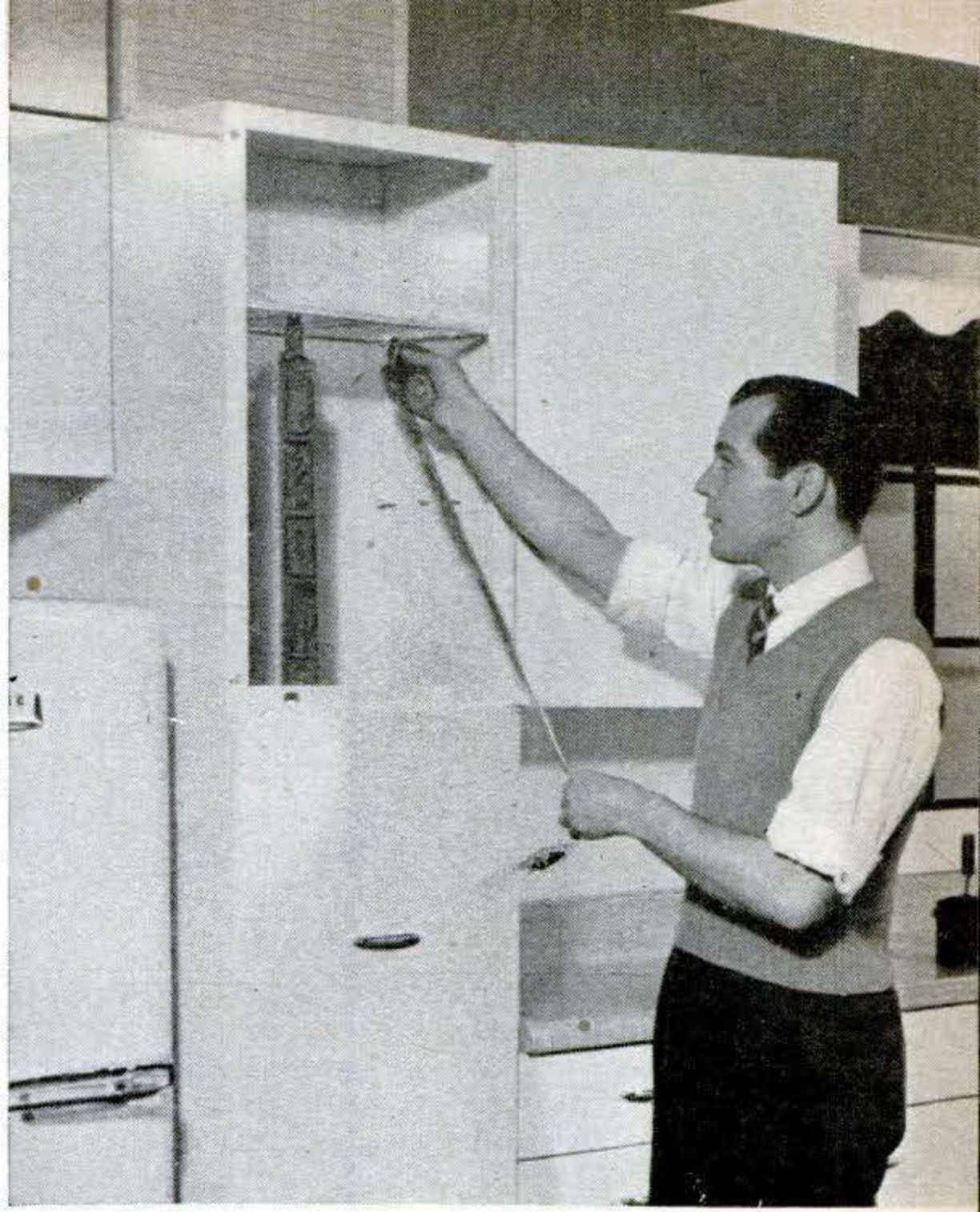
As a solution to this problem, two leading manufacturers have designed a modern kitchen that also doubles as a darkroom. It provides work and storage space for the photographer and is arranged to keep the hypo out of the bean soup and, perhaps, make a photographer out of the housewife too.

It's a kitchen first. The model room set up by the General Electric Home Bureau and F-R Corp. looks like any other spic-and-span modern kitchen. The planners wanted it that way, for a major objective was to keep from interfering with normal kitchen activity. But looking closer, you find many little tricks and gimmicks to please the photographer of the family.

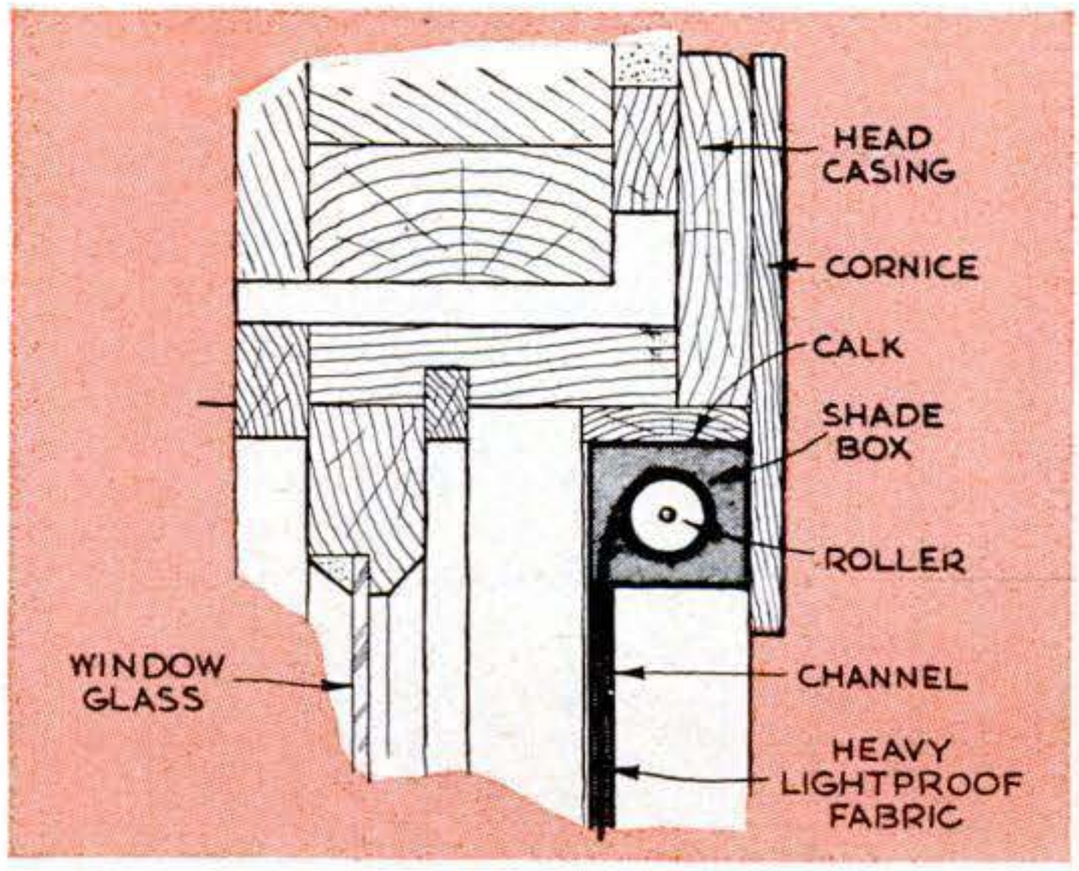
You can black out the room in full daylight simply by pulling down a heavy-fabric shade, camouflaged behind a good-looking valance. The shade, made and sold for the purpose, is a pleasing green color instead of the black you might expect.

Two electric-light sockets, with separate switches, are located under the base of a wall cabinet. A red bulb in one serves as a safelight. A white light in the other can be used to make contact-print exposures in a printing frame resting on the counter below. Convenience outlets under the cabinet can be used for a toaster, an electric percolator, a print timer or an enlarger.

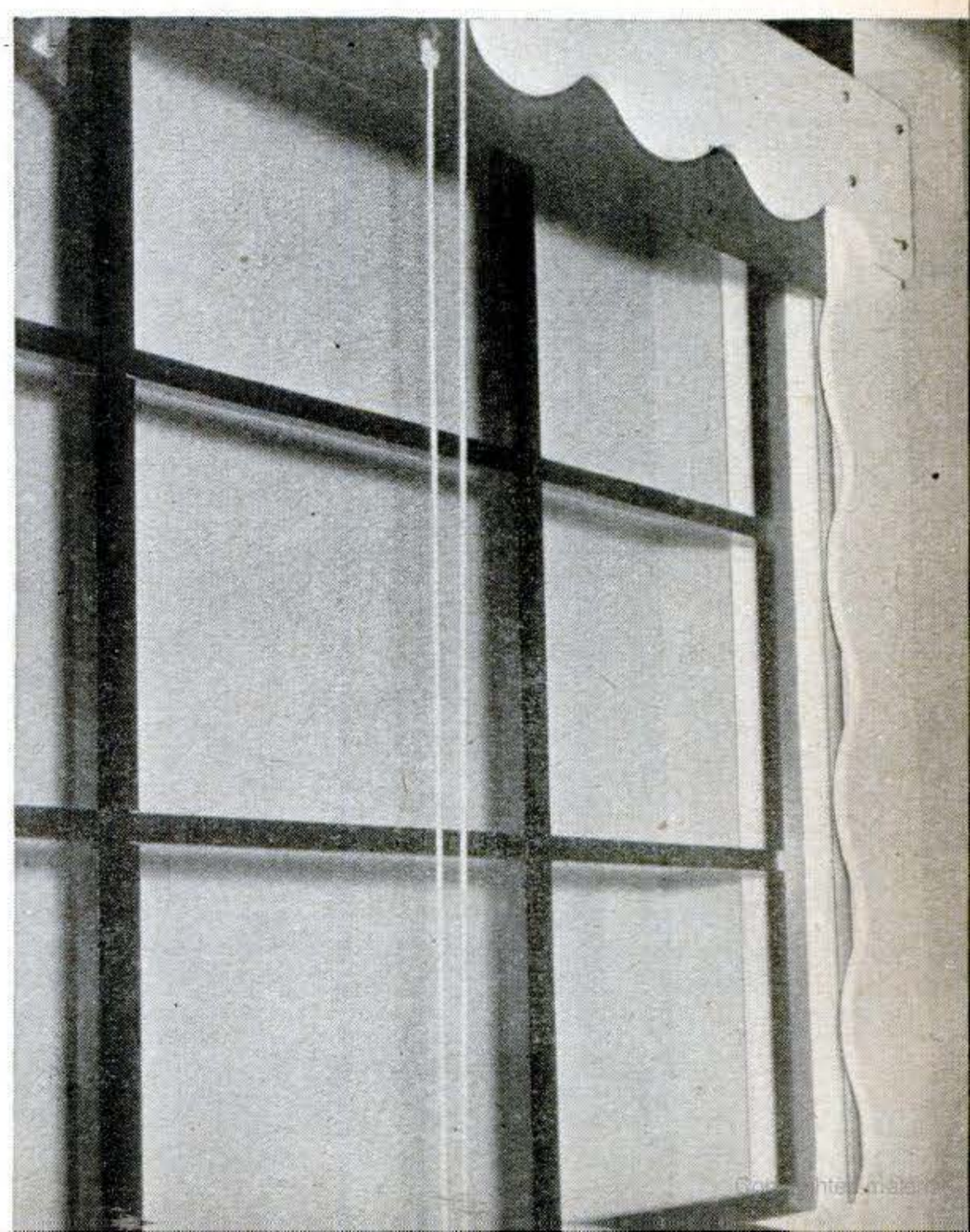
Over in one corner of the model kitchen-darkroom is a unit the photographer can call

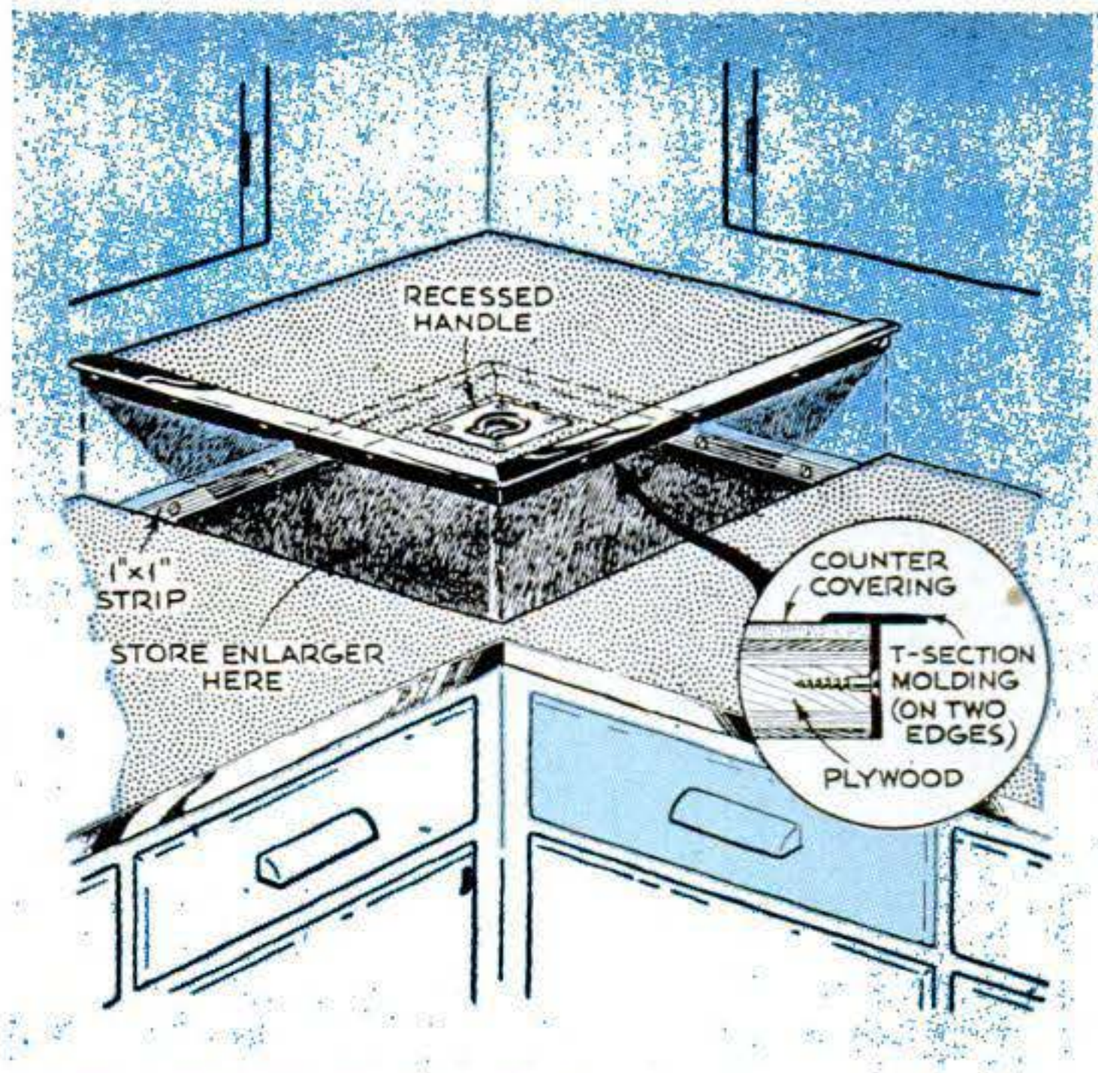


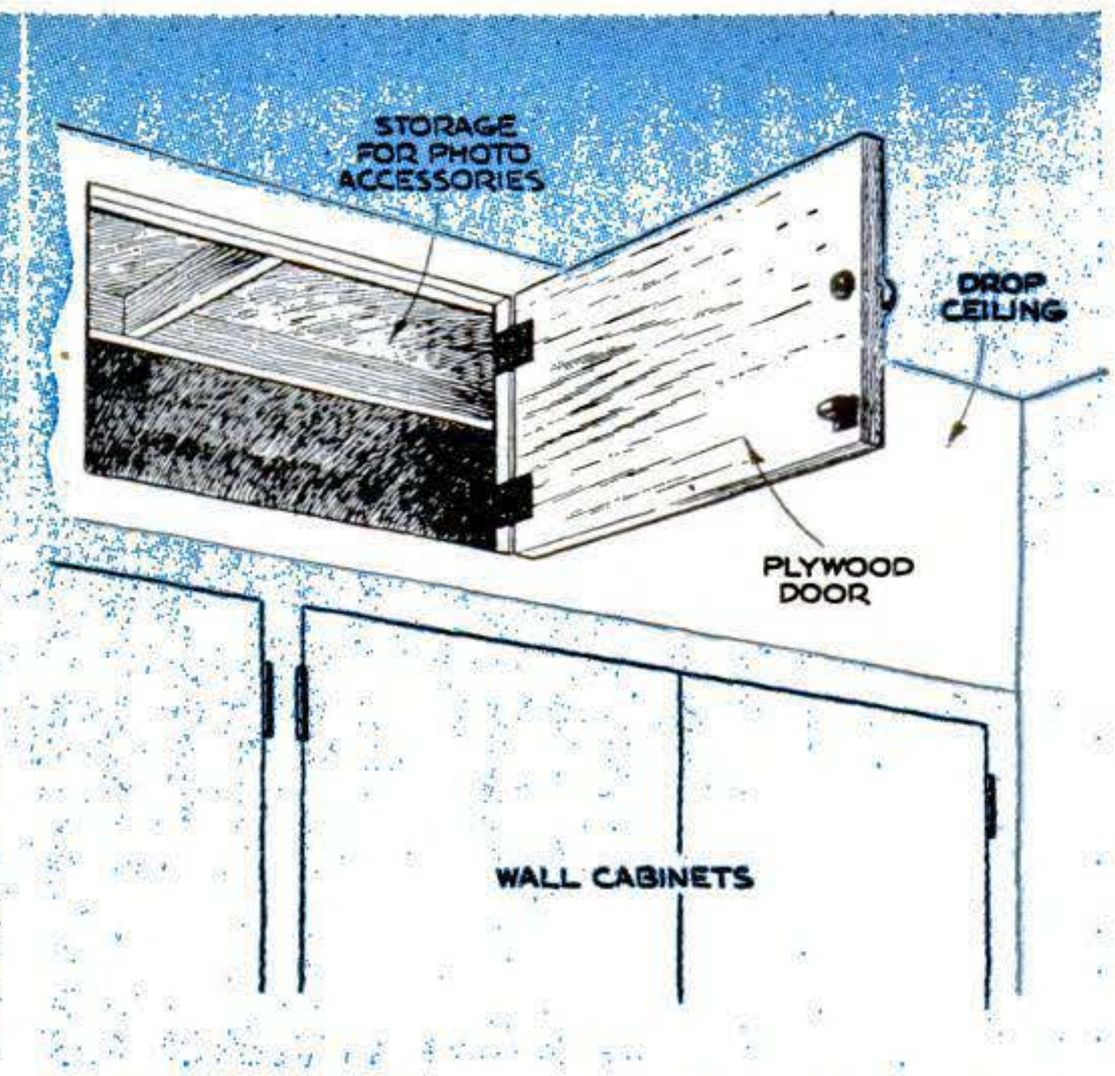
TALL UTILITY CABINET does double duty as film drier when brooms and mops are removed. Small electric-fan heater set in bottom would exhaust moisture through grille in cabinet top.



SPECIAL BLACKOUT SHADE darkens room even at midday. Edges of shade slide up and down in metal channels that act as light traps. A decorative cornice hides shade when it is rolled up. This blackout unit is made by Bar-Ray Products, Brooklyn, N. Y. Doors can be made light-tight with weather stripping. For complete blackout, you must remember to cover up gas-range pilot, keep refrigerator closed.





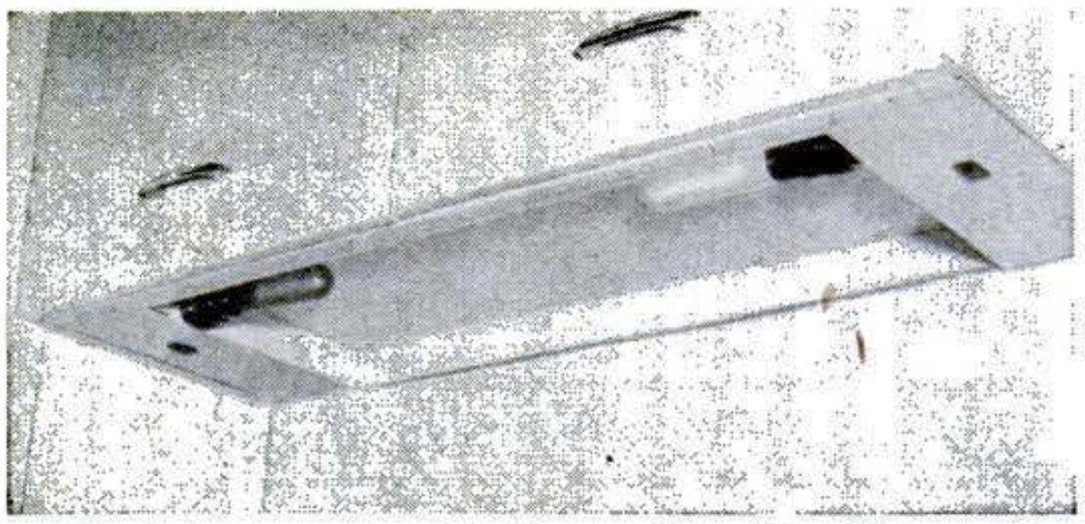


EXTRA STORAGE SPACE for photo equipment might be found in some kitchens as suggested in these drawings. When commercial cabinets are installed along two walls at right angle, waste space is sometimes left in corner. If wall cabinets above do not interfere, a bulky enlarger might be kept in this space. When the kitchen has a dropped ceiling above wall cabinets, a door or two installed there will give space at least for dead storage.

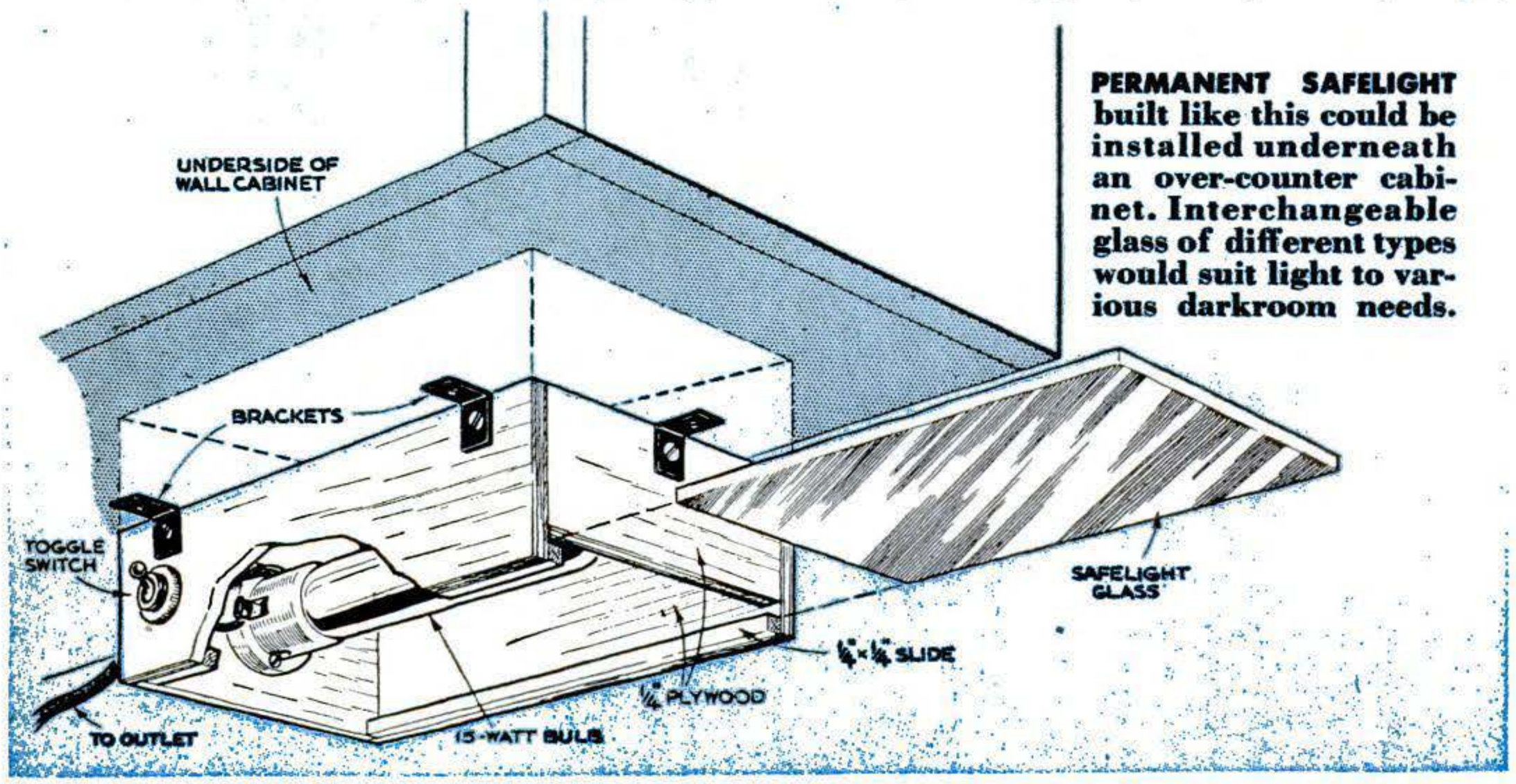
mostly his own. In outward appearance, this is a kitchen planning desk. Nearly all new kitchen layouts nowadays call for one of these—a place where the cook can sit to plan meals, read recipes, keep her accounts and phone the butcher.

The cook can still use this unit for these activities. A drawer is reserved for her use. But the shelves underneath have been set aside for the photographer's equipment.

Don't miss PSM's index of Mechanics & Handicrafts articles for Volumes 159 and 160. It's in this issue, pages 187 and 191.



CONCEALED LIGHTS in base of wall cabinet give housewife good working illumination, let photographer substitute a safelight bulb or make contact-print exposures. The unit has two convenient electrical outlets, too.



PERMANENT SAFELIGHT built like this could be installed underneath an over-counter cabinet. Interchangeable glass of different types would suit light to various darkroom needs.

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News from the Camera Shops

Telephoto Couples to Finder

OWNERS of Argus cameras can now switch quickly to a telephoto lens that couples right to the range finder. Developed in Germany, the Tele-Sandmar has four color-corrected elements, click f stops, and a sunshade and filter holder. A special coupler gear, substituted for the original one, permits the new lens to be used with the regular range finder. The helical focusing mount keeps all markings at the top of the barrel. *Geiss-America, Chicago.*

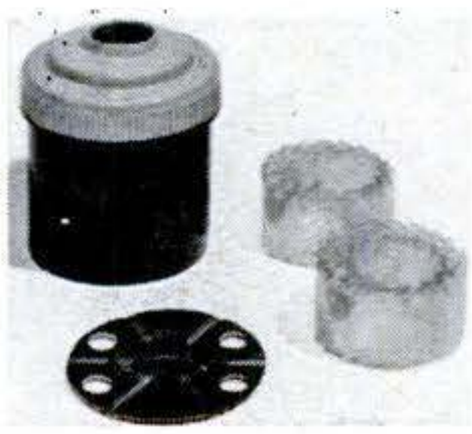
Battery Tester Checks Bulbs

WITH one dual-purpose unit, you can test all sizes of flash batteries and bulbs. When you place a battery in the bracket and press the push button, the round indicator should show more than half green if the battery is perfect. Perfect bulbs also cause the green light to show. Testing does not cause the flash bulbs to fire. *Bright Star Battery Co., Clifton, N. J.*

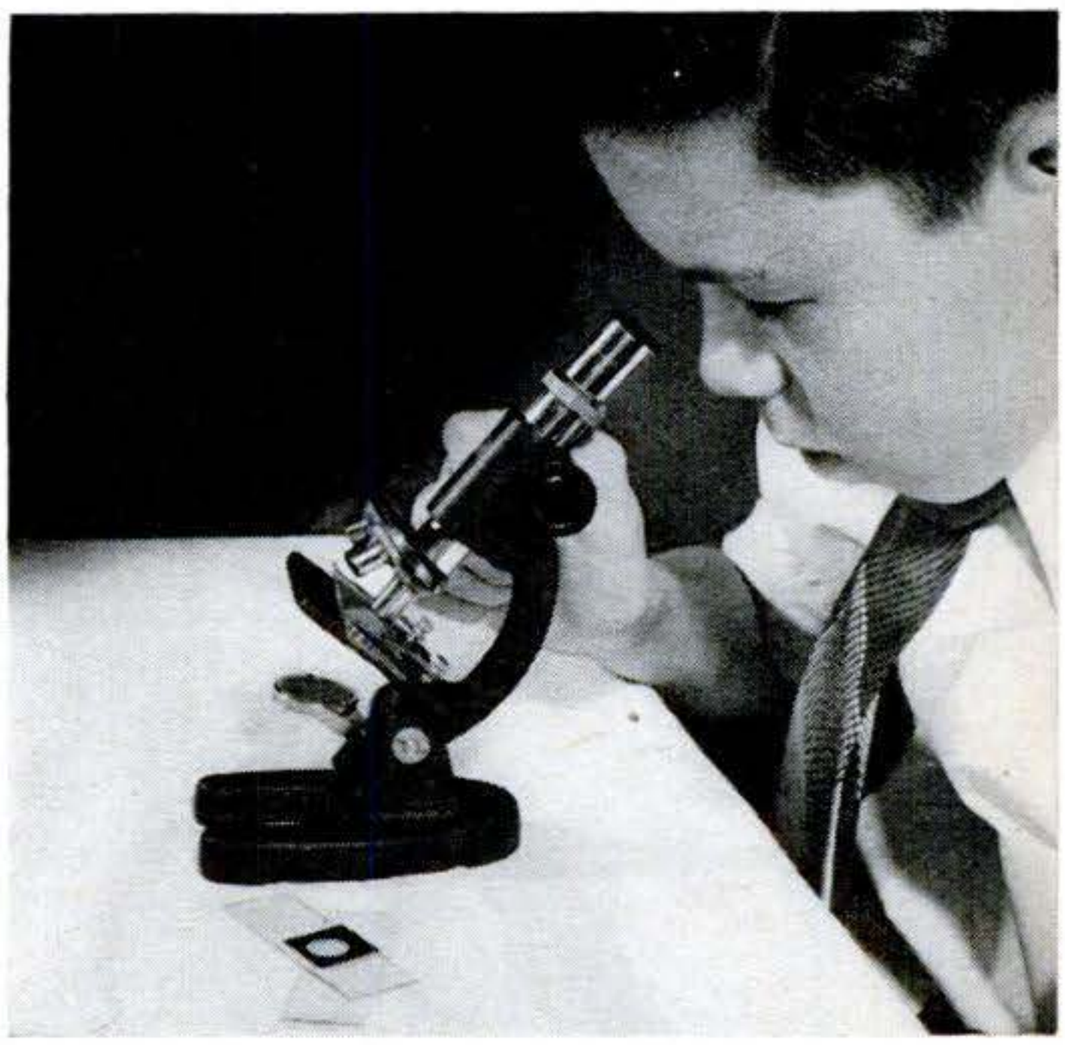
Photo Adhesive Is Re-Usable

PHOTOGRAPHERS will find a new type of adhesive useful for mounting photos in an album or for holding down projection paper while borderless enlargements are being made. Called Plasti-Tak, it can be used over and over again, and will stick to glass, wood, paper, cloth or metal. It must be prepared for use by pulling it like taffy. *Brooks Manufacturing Co., Cincinnati 24.*

Aprons Develop Miniature Film



Two rolls of 35-mm. or 828 film can be wound in the plastic aprons shown here and then developed simultaneously in the Kodacraft Miniature Roll Film Tank. Once the tank is loaded, all developing can be carried out in full light. *Eastman Kodak Co.*



Low-Cost Scope Has 3 Lenses

THE revolving turret of this inexpensive microscope gives you a choice of three lenses— 100 power, 200 power and 300 power. It has a fine micro focusing adjustment and an adjustable plano substage mirror. The microscope sells for $14.95, including a hardwood case. *The Akron Co., 4400 Sunset Blvd., Los Angeles.*

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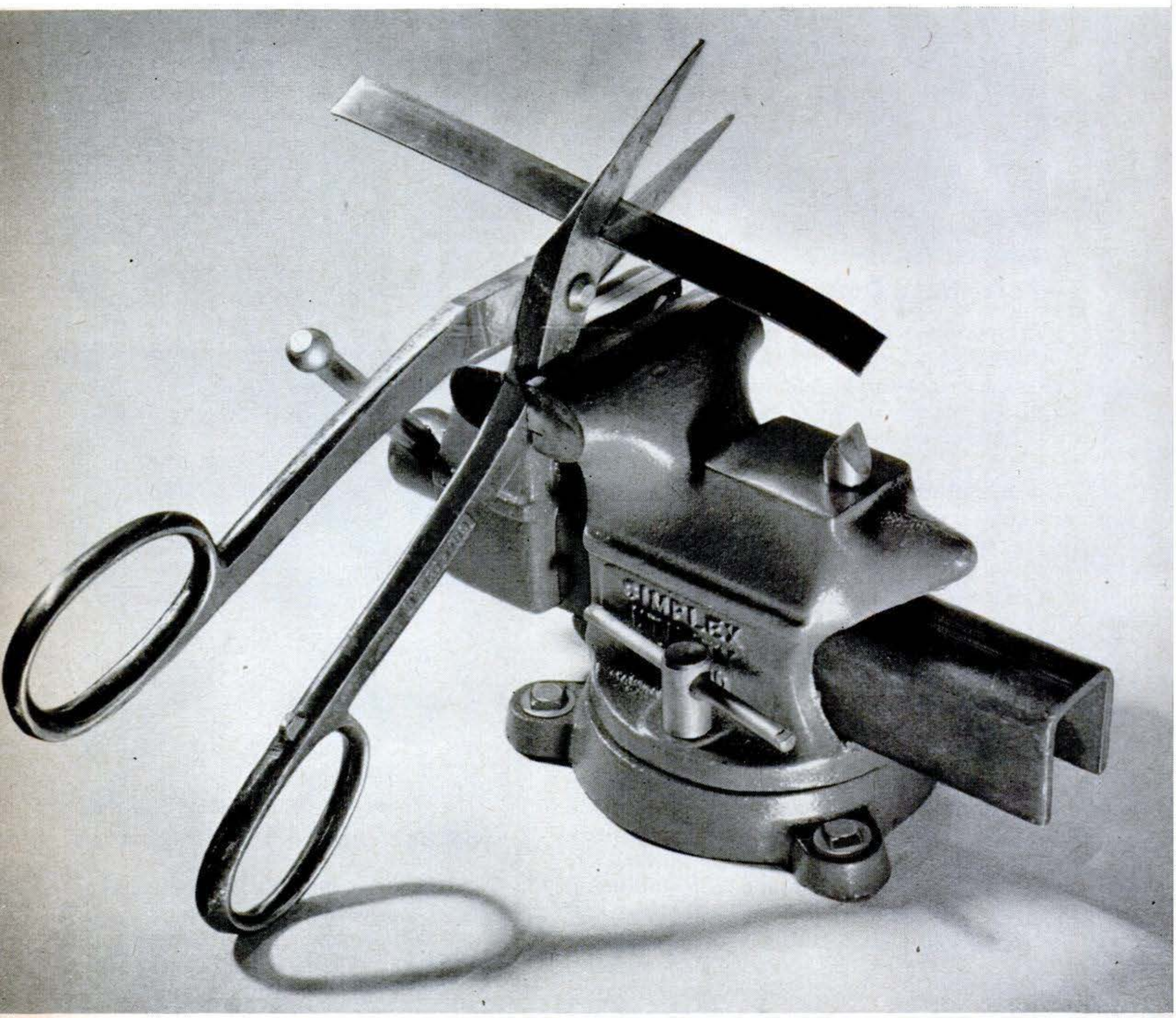
17 Extra Uses for Your Vise

By Walter E. Burton

Nothing in your shop is so powerful or so willing to serve.

THOUGH you may never have considered it a tool, you've got a powerful helper on the corner of your workbench. A vise will hold your work tenaciously while you hammer and saw and drill. But that's not all it can do. The photos that follow show the bench vise tackling jobs that are far afield from humdrum holding duty.



TIN SNIPS, clamped in a vise with one handle resting on the bench, can slice through material that would be very difficult to cut with the conventional grip. Here the strip being severed is a little too wide to be nipped with one blow over the vise cutoff tool on the anvil.

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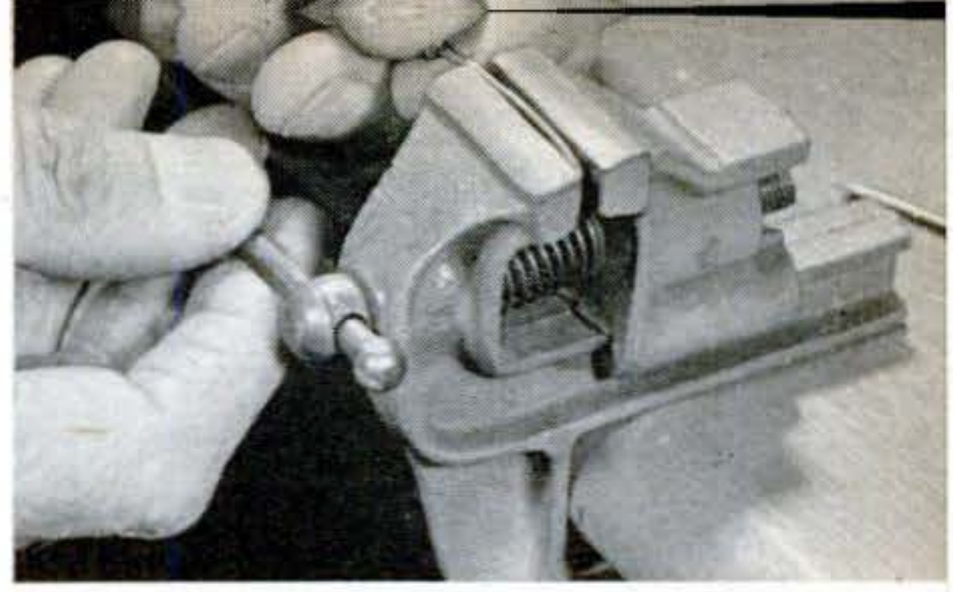
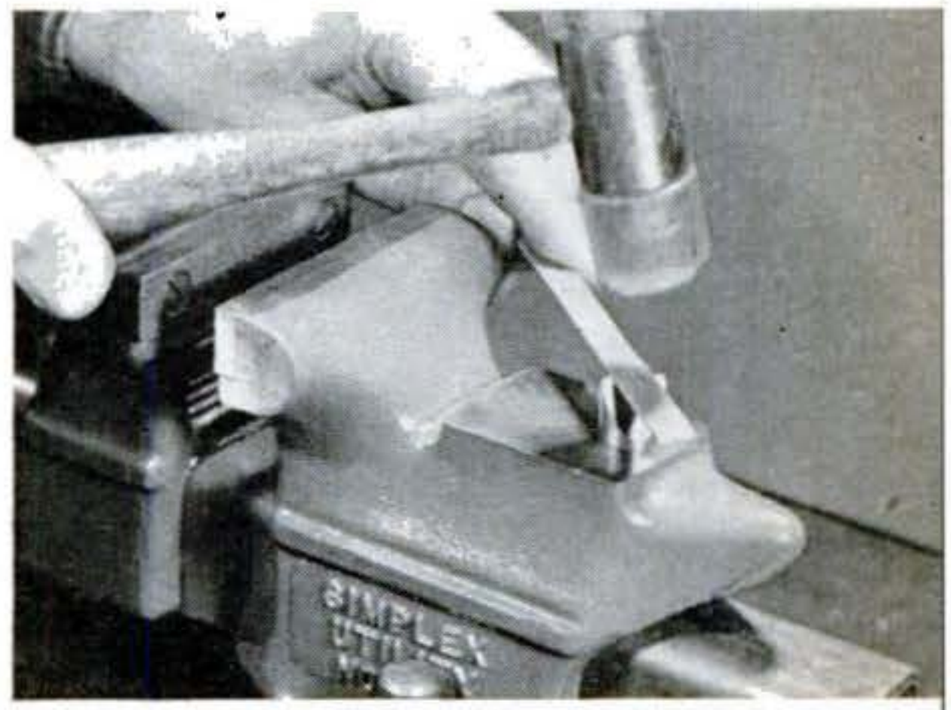
REMOVING DENTS from brass and aluminum ware is one job that even this tiny vise can do. Squeezing is often better than hammering as pressure is controlled and positioning is precise. A hardwood block is used to work inside the flange and distribute pressure.

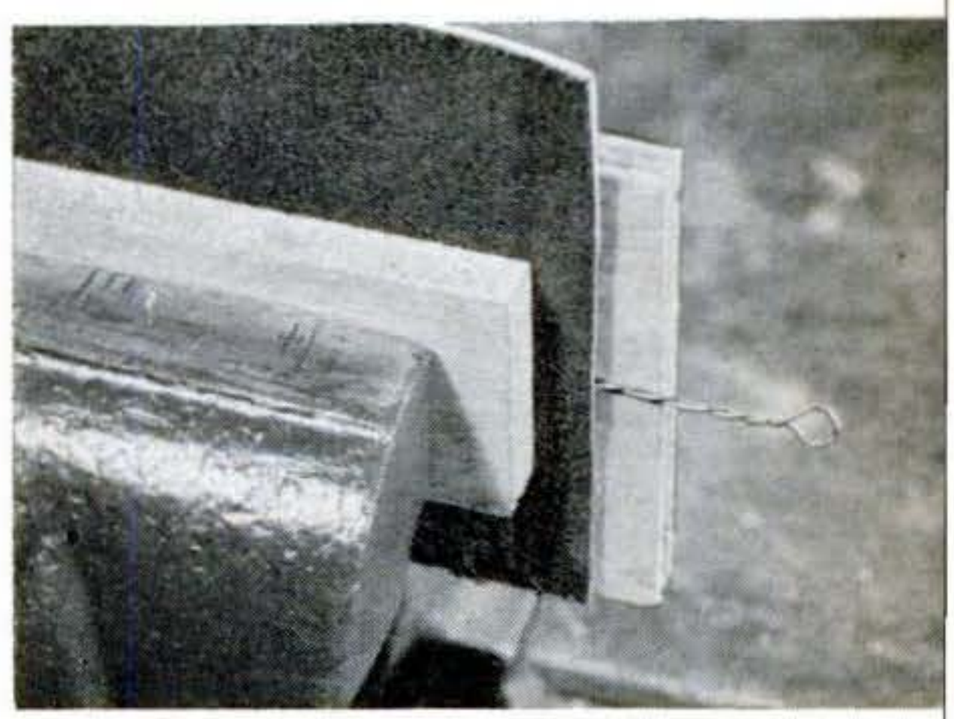


STRAIGHTENING NAILS with a small clamp-on vise beats hammering them out, and saves fingers, too. A vise of this type is handy to have around the kitchen or in the toolbox. It sets up at a moment's notice for the many small jobs that pop up in the home.

BLOCK PRINTING on a small scale is done by briefly, but firmly, pressing the inked linoleum cut on paper backed with cardboard and plywood. Vise in this photo is an unusually agile woodworker's vise that tilts forward and backward and swivels on its base.



CUTTING OFF strips of metal or wire is a jiffy job for a vise equipped with a hardy—a hardened steel cutoff tool. Similarly, sheet plastic or thin wood may be cut or notched. The cutoff tool can be replaced by stakes of various designs for beating metal into shape.



EMBOSSING LEATHER. Twisted wire is pressed into moistened leather to form decorative line. Two pieces of plywood complete sandwich, which is held under pressure until leather dries. Dies and type can also be impressed in this way. *Please turn the page.*

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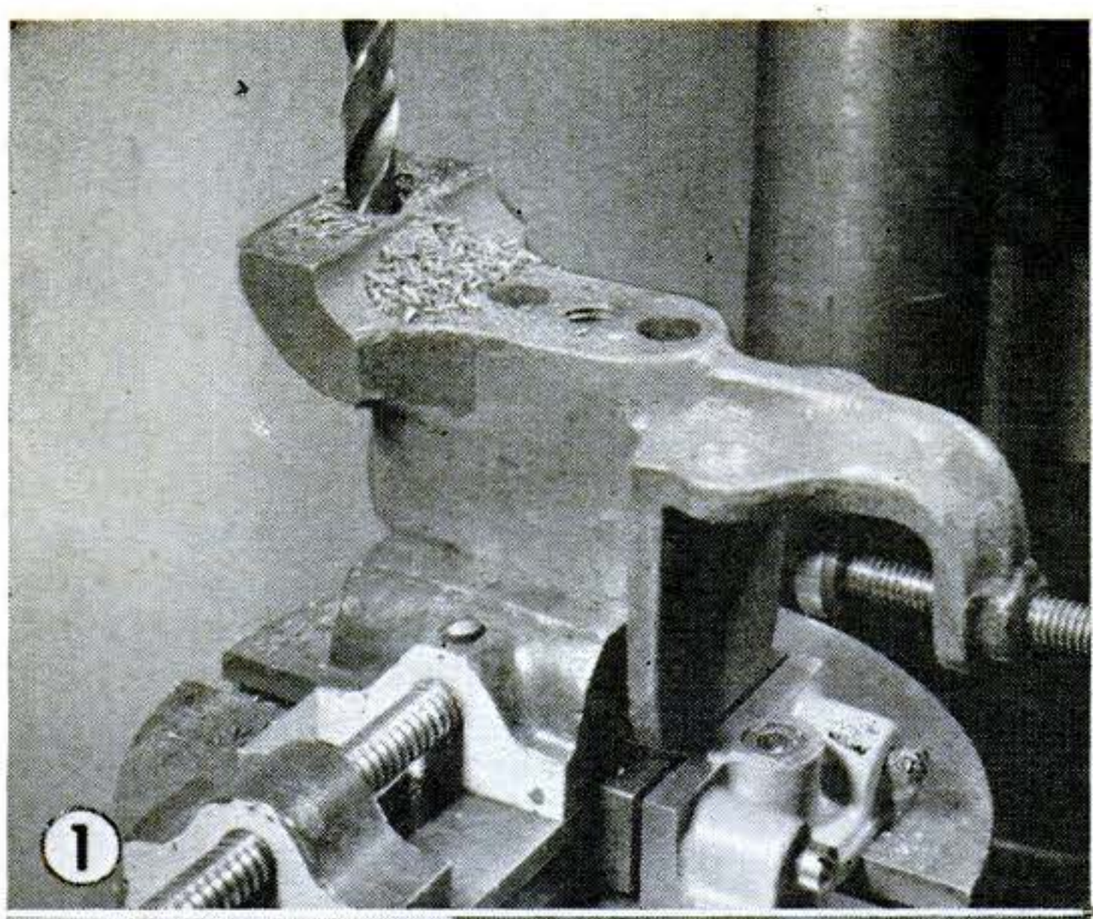
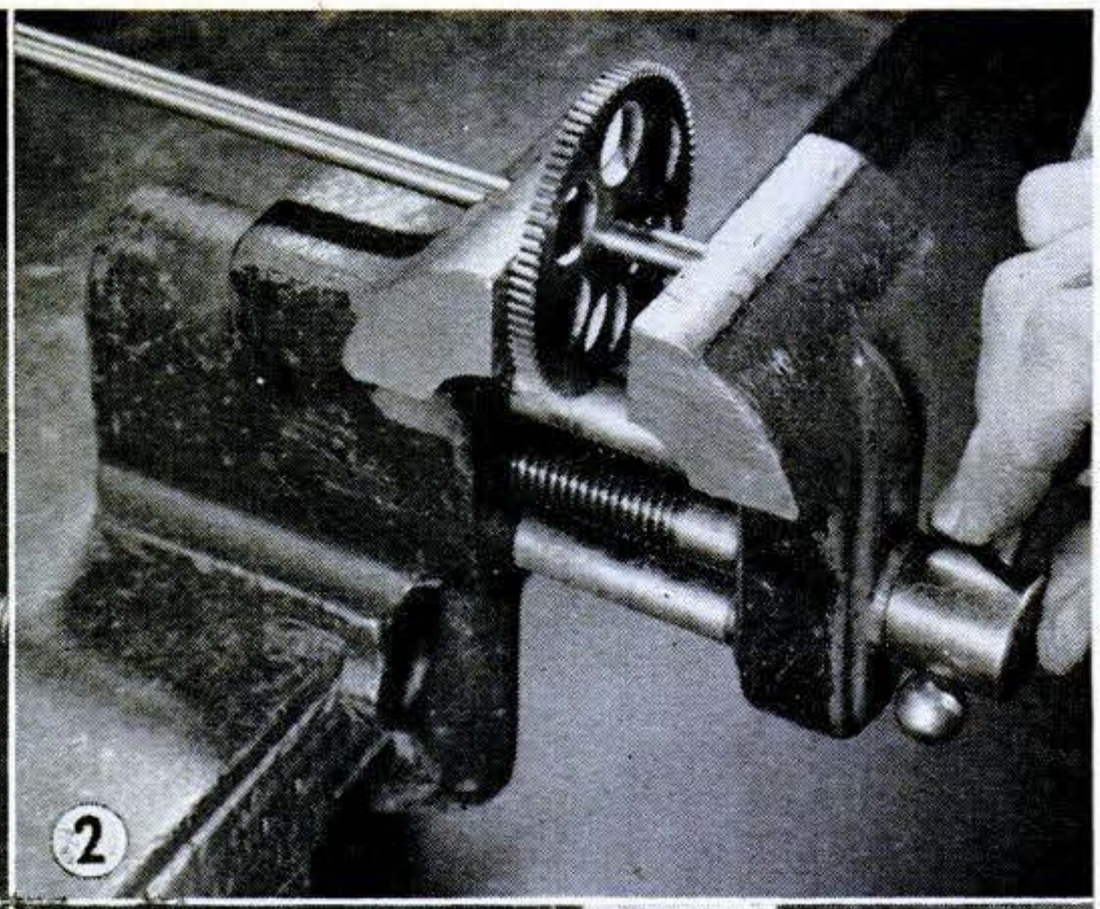
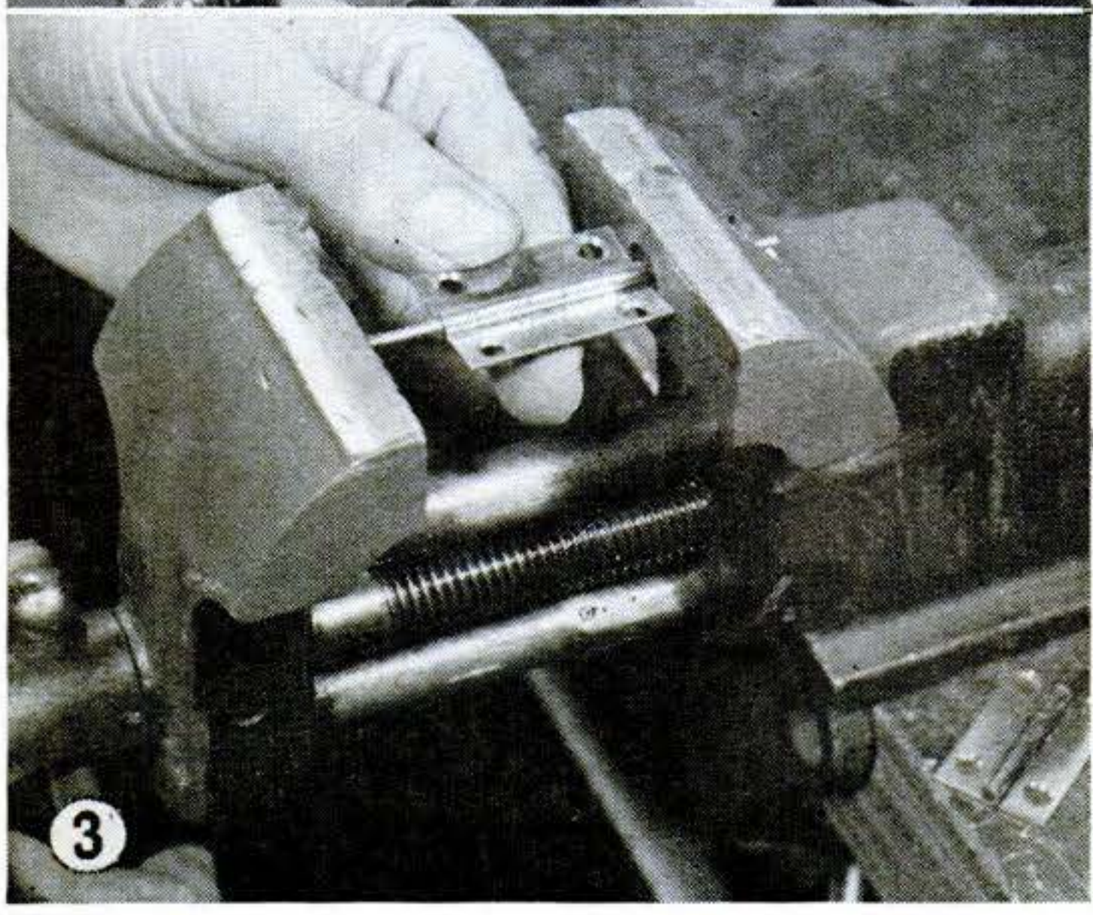
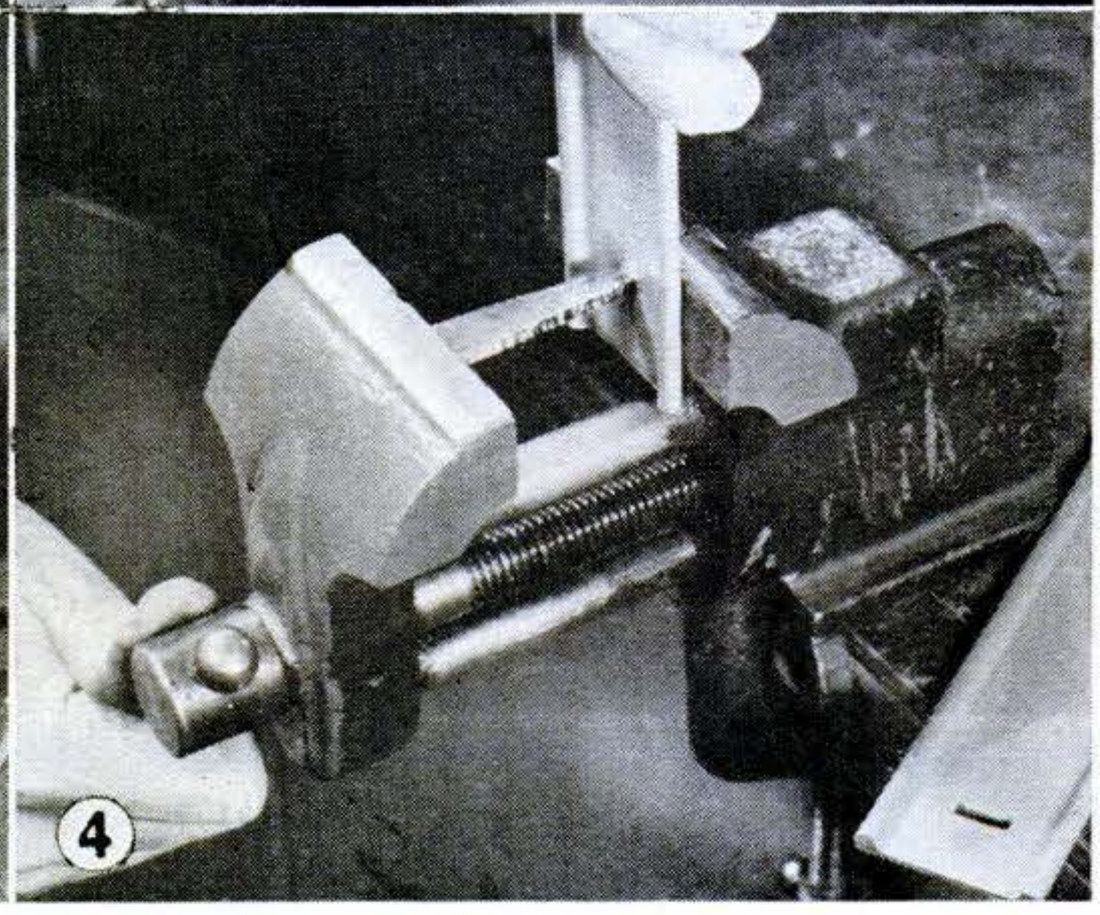




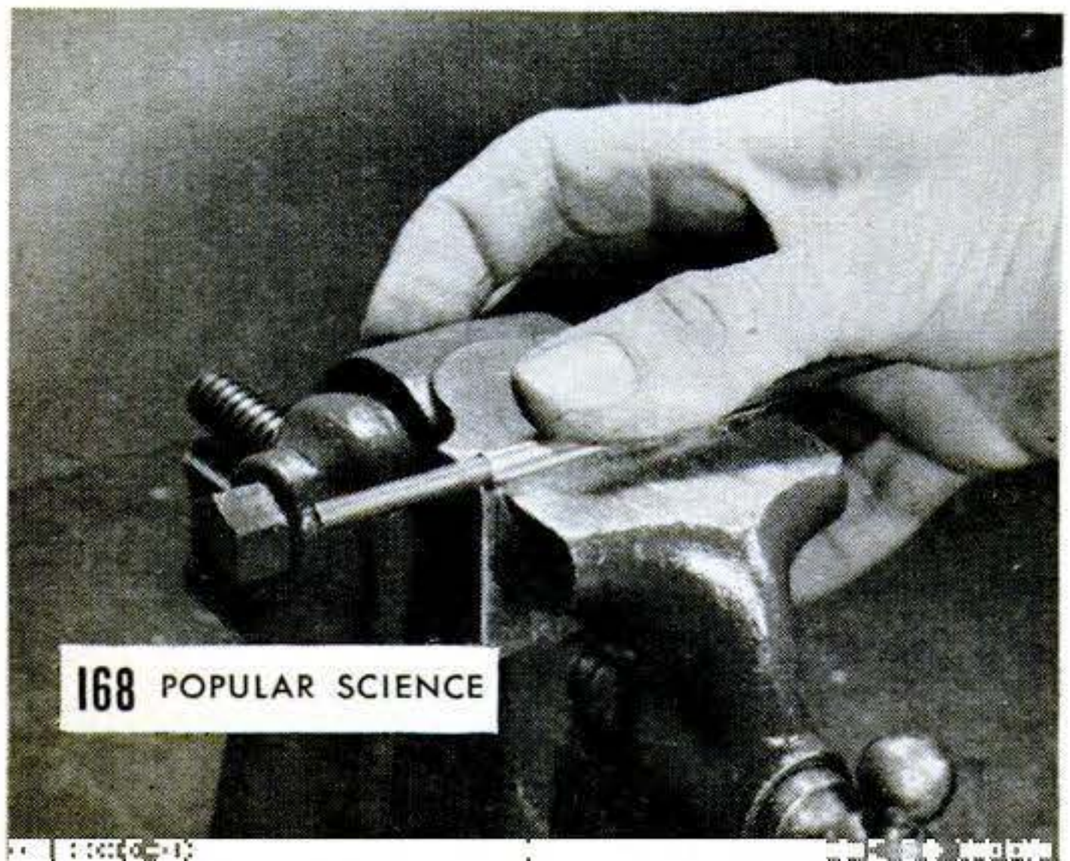


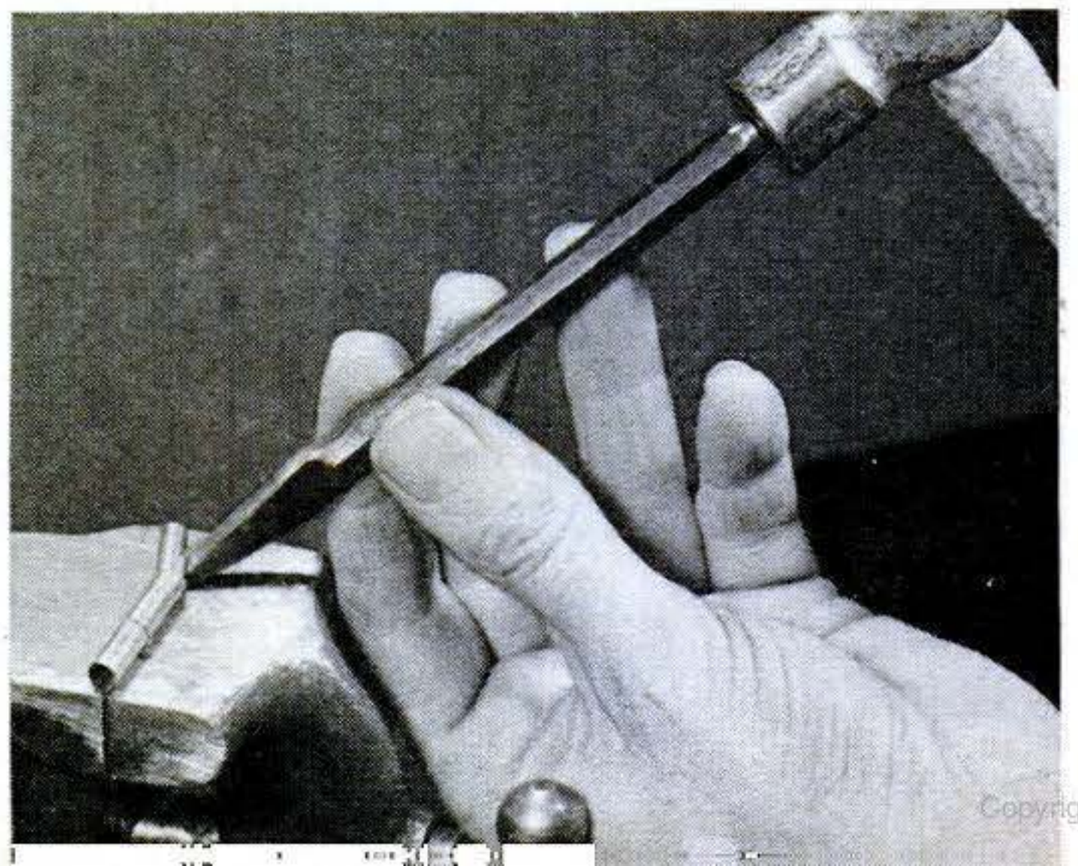


HOLE, DRILLED THROUGH ONE JAW, (Fig. 1) will extend usefulness of vise, making it second cousin to an arbor press. Do not try to drill through a hardened jaw insert; if your vise has them, remove one and replace with a block of mild steel. Pressing gears, pulleys, collars and ball bearings off shafts is light-duty work for average vise (Fig. 2). Ball bearings must be backed up with a ring or washer having a hole the same diameter as the shaft so that pressure will be on the inner race, not the outer one. Removing tight hinge pin (Fig. 3) without damaging or distorting hinge calls for firm, even pressure that is kept under constant control—a natural characteristic of the vise. Nail, with end filed flat, is used to push pin through barrel of hinge, out through hole in vise. Broaching square or rectangular holes with quickly made taper broaches is easy method of producing such openings (Fig. 4). Here again, the hole in the vise jaw permits the broach to penetrate to whatever depth is necessary to produce the desired hole size. Undersize starting hole is drilled in sheet metal and broach is forced into it. Teeth filed in edges cut as broach penetrates metal.

SHAPING SHEET METAL around a rod is first step in producing a homemade hinge. The material should be pressed down into the vise jaws so that the jaw edges squeeze the metal close to the rod, forming a tubular opening for the hinge pin.

COLD CHISEL does clean job of shearing off metal close to the vise jaws. The hinge leaf is notched with a hacksaw and the unwanted sections cut off. Here the two end sections are removed, but on the matching leaf, only the center section will be cut away.





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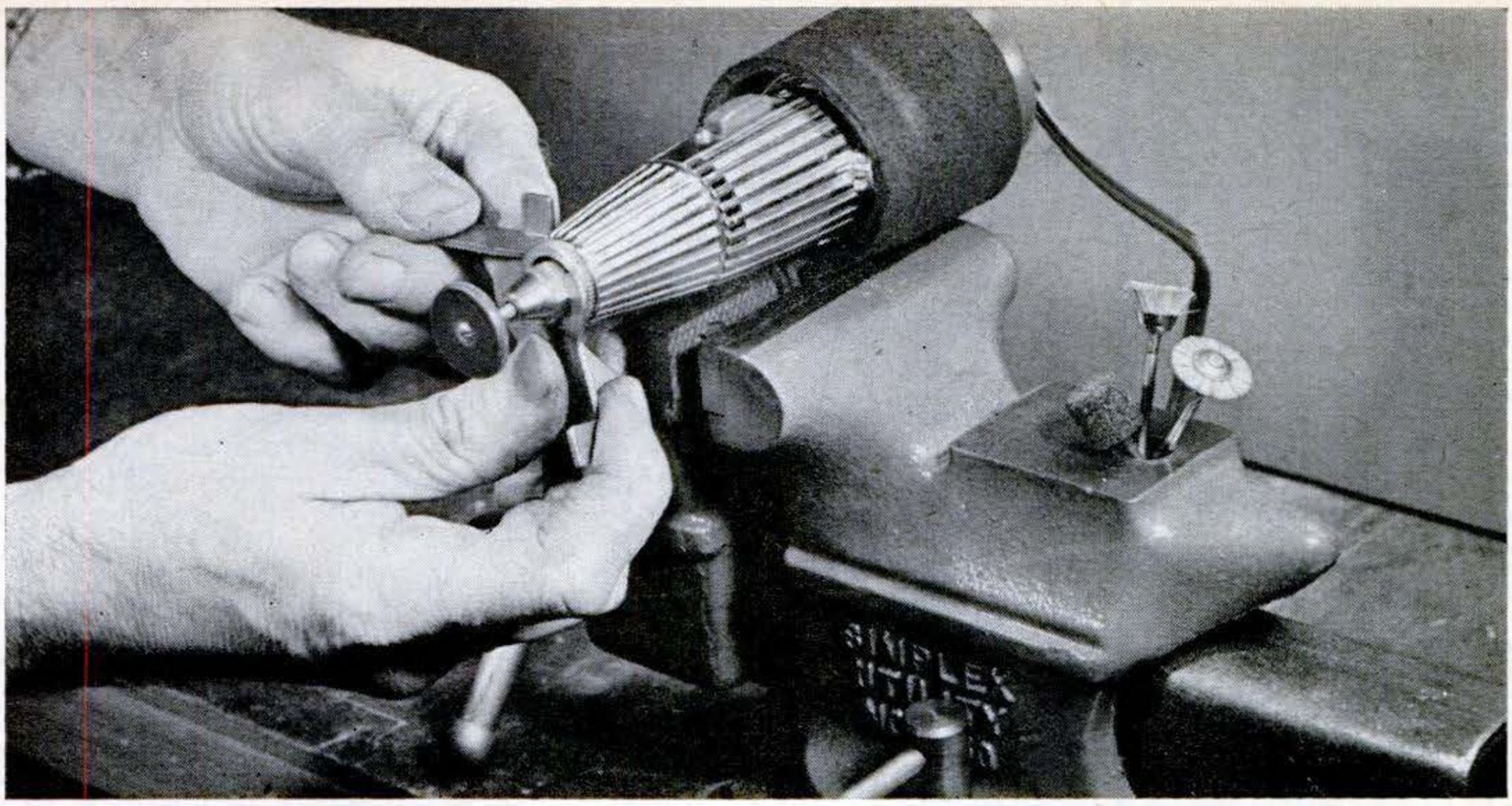
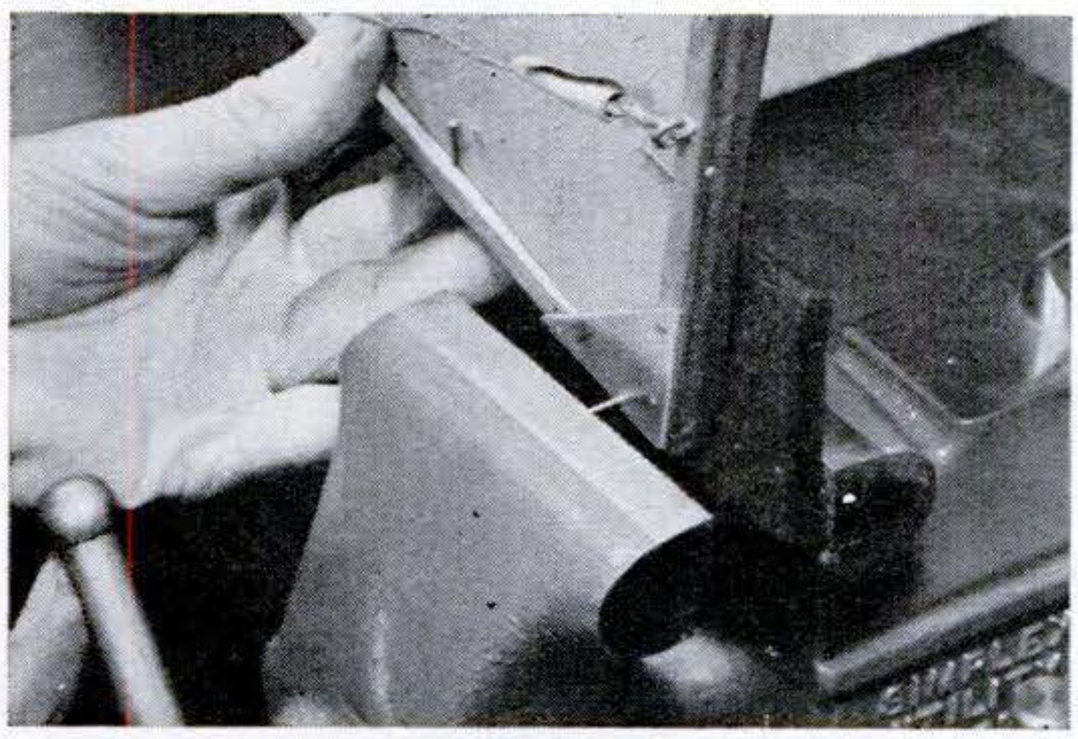
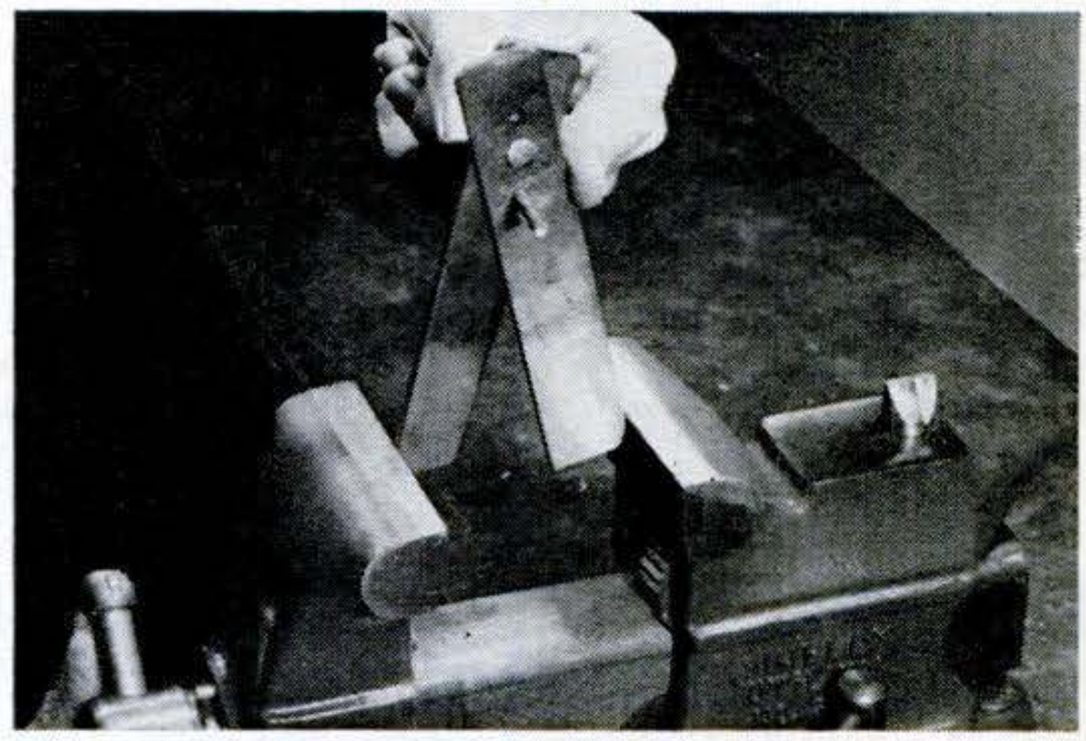


HAND GRINDER is held safely and securely by wrapping it in a strip of leather or fabric-reinforced rubber and clamping the ends in a vise. The socket for the vise cutoff tool makes a convenient holder for keeping small buffing and grinding wheels while you work.

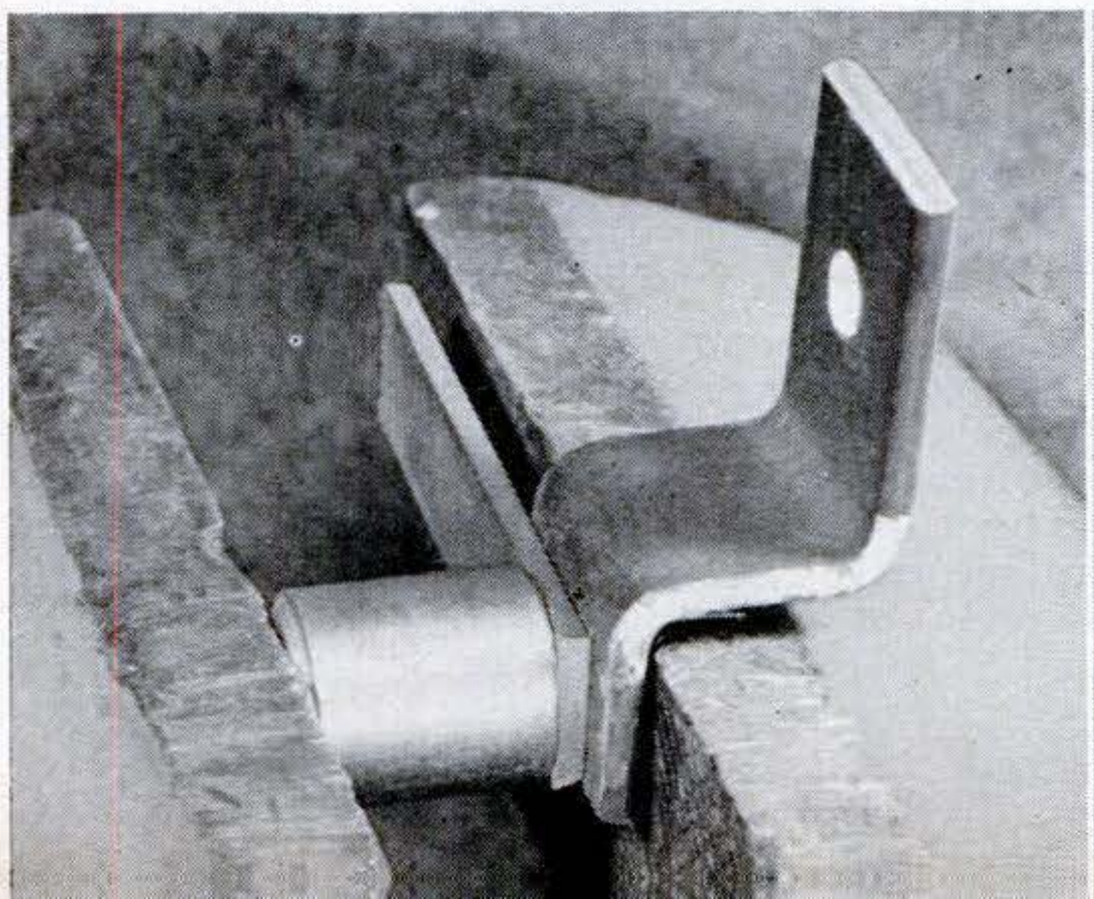


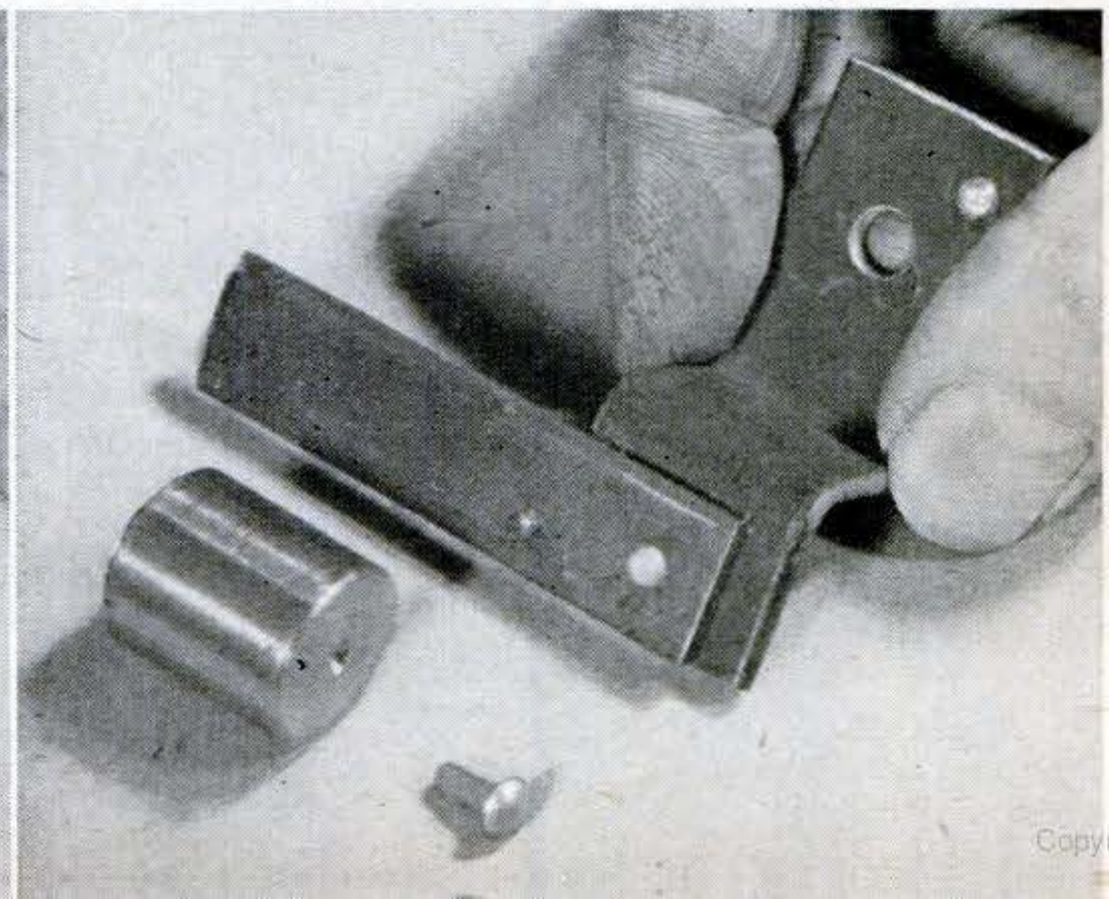
NAILING WITH PRESSURE eliminates hammering close to glass, as on picture frames or mirrors. Felt pad protects finished side of frame. This dodge is also useful for the craftsman working late at night, when use of a hammer for driving nails would disturb others.



SHEARING TOOL cuts rod stock with ease, exerting even pressure as vise jaws are closed. Tool is made from two halves of a flat file, annealed while several sizes of cutting holes are drilled and then rehardened. Drill-rod pivot pin is riveted over on both sides.

SQUEEZING RIVETS is easy work for a husky vise. Aluminum rivets respond beautifully to the squeeze treatment. The riveting tool is a steel rod having a half-round depression in one end to form the rivet head. At right below is a riveting job and the tool that did it, with the help of the vise. Half-round depression in tool is made by dimpling with a round-nose bit. If tool is used for quantity riveting, make it from drill rod, hardened and tempered to a blue color. For convenience, fasten it to one of the vise jaws. *Please turn the page.*





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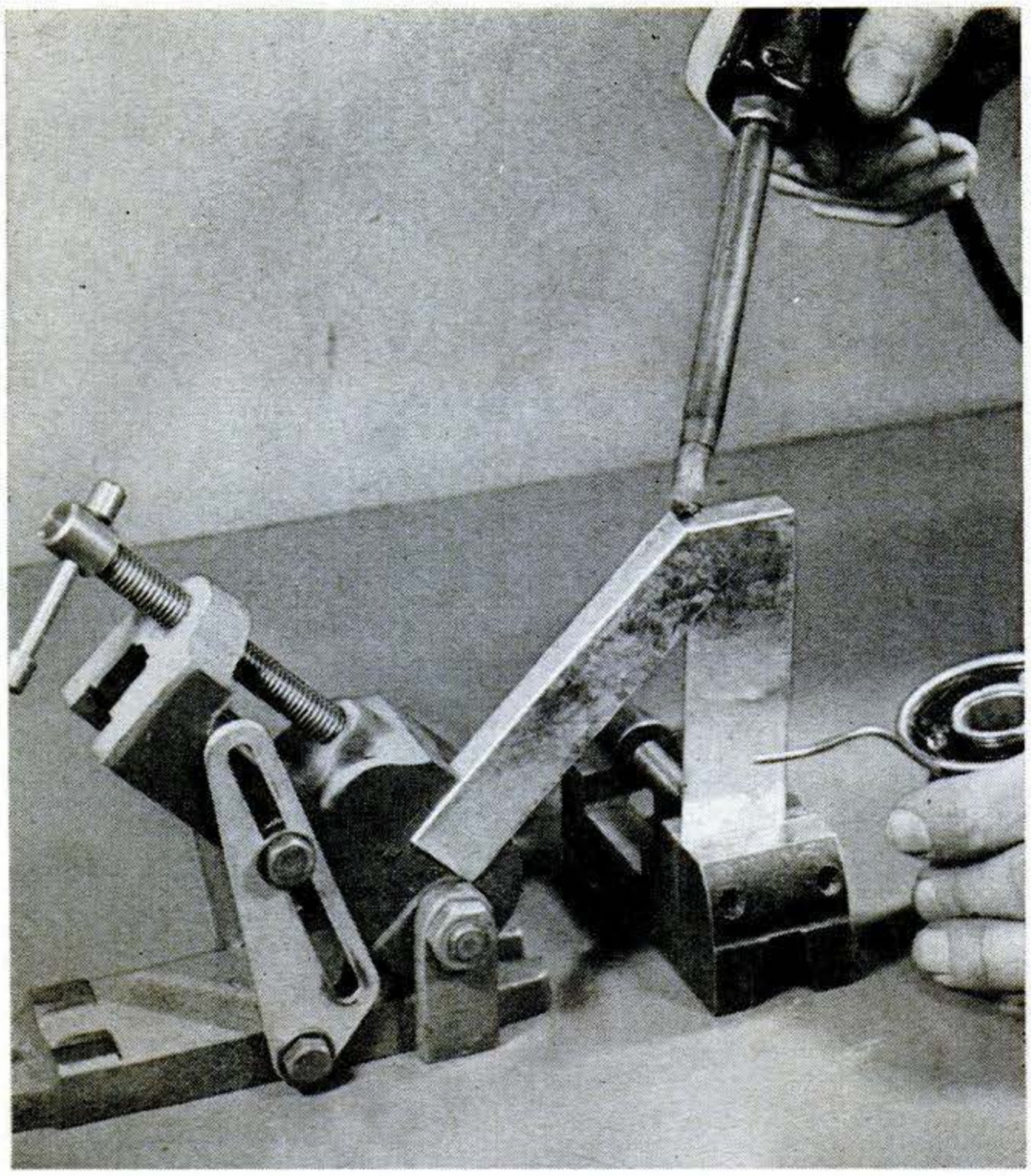
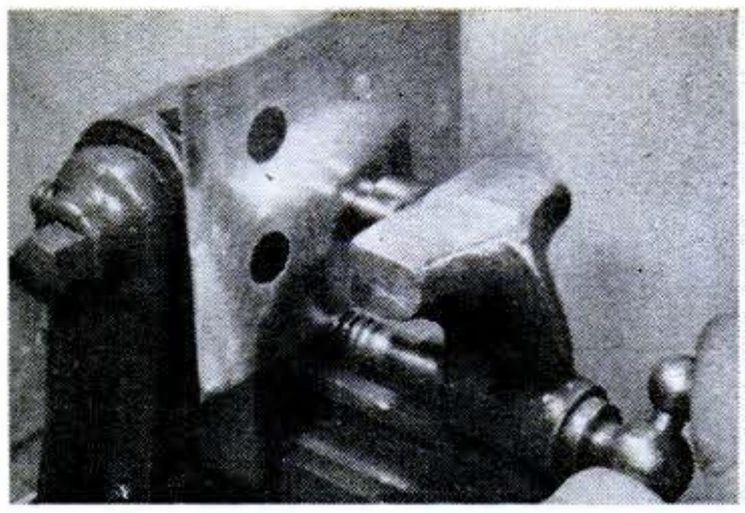
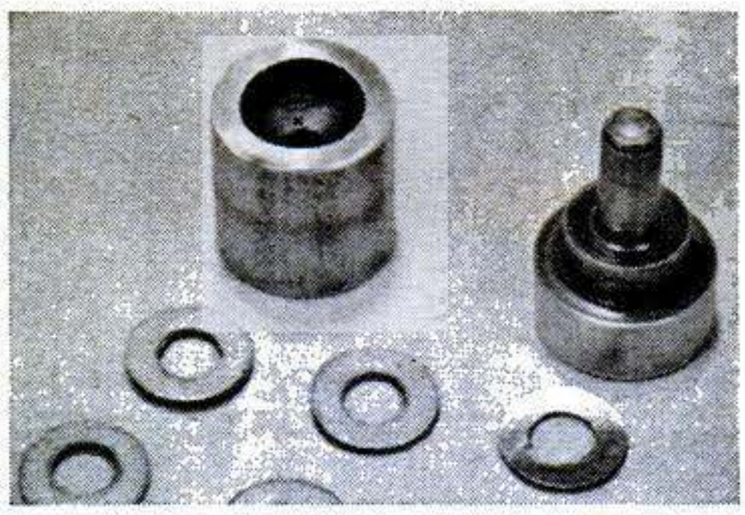
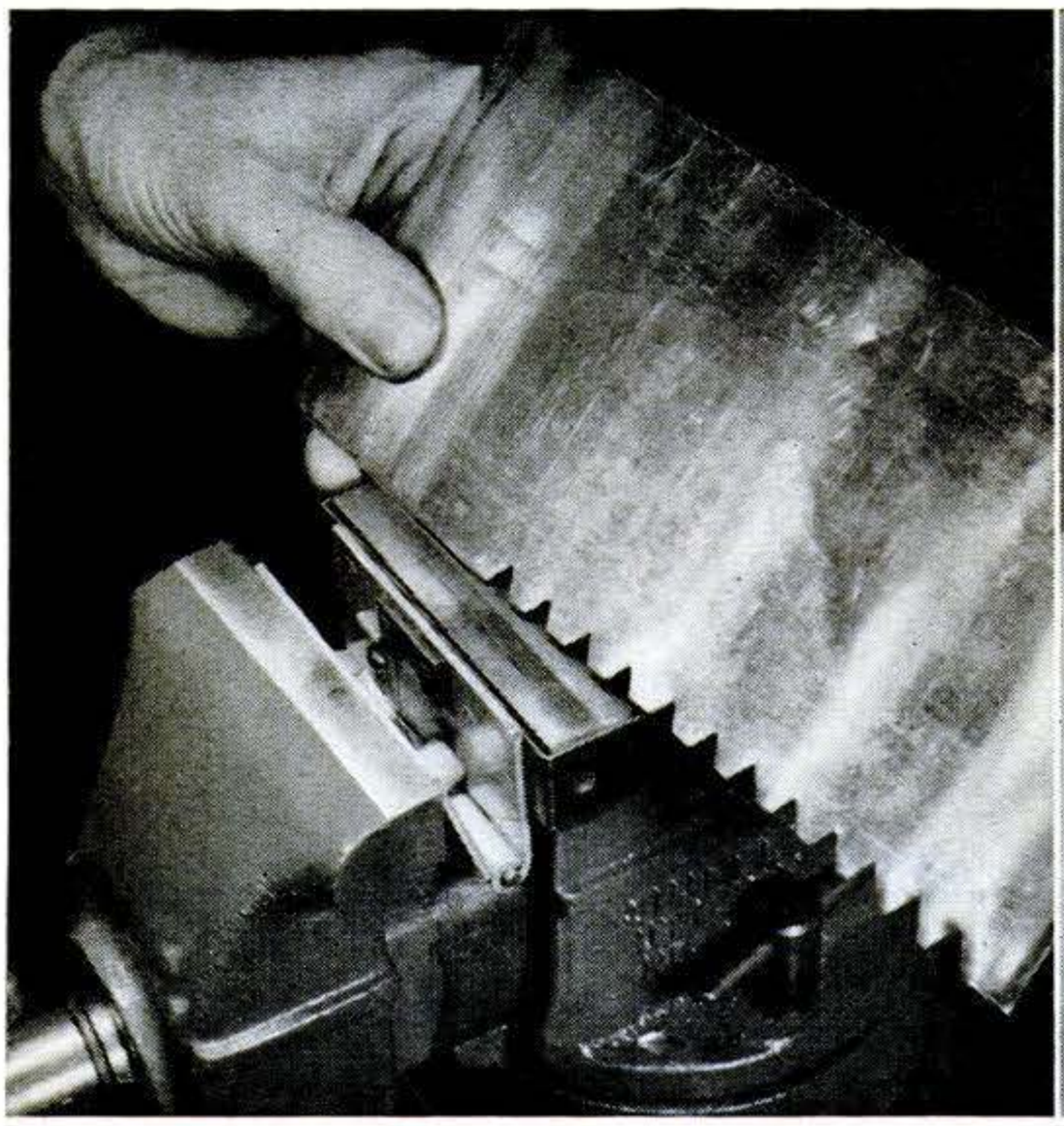


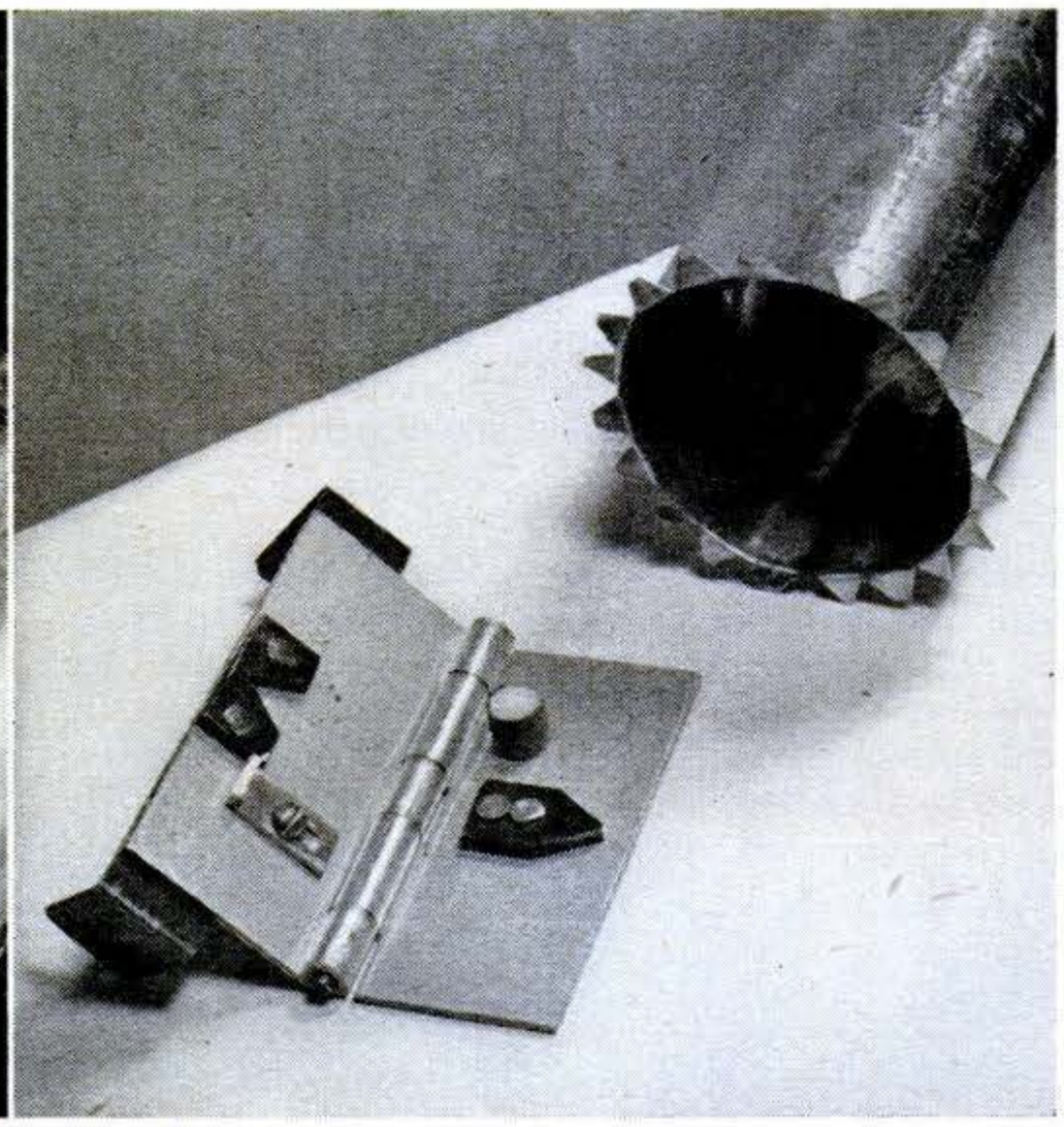
DRILL-PRESS VISES, too, have uses other than holding work for drilling. Here an angle vise is used with a standard vise to bring two parts together for soldering. The angle vise also indicates the angle at which the part is held, and is quickly adjusted to any degree.



PUNCHING HOLES or stamping out washers from sheet metal fully utilizes the powerful forces at your command. Since sheet metal is very difficult to drill cleanly, punching is often the answer to the problem of making truly round holes, especially in the larger diameters. Below is punch and die set, along with some washers stamped out of sheet metal and thin fiber. The tip of the punch forms the hole, and the washer is cut by the next larger diameter. The washers must be removed by hand.







NOTCHING SHEET METAL with a simple notching device set in the jaws of the vise. This process simplifies the bending over of flanges on tubular forms to be soldered, as in the photo at right above. Cuttings should be brushed from the hinge occasionally. Notching tool consists of pair of dies, made from flat tool steel, riveted to a heavy hinge. The L-shaped bracket regulates the notching depth and the rubber button springs the die apart after each cut. The U-shaped spring clip holds the tool in place on the vise jaw.

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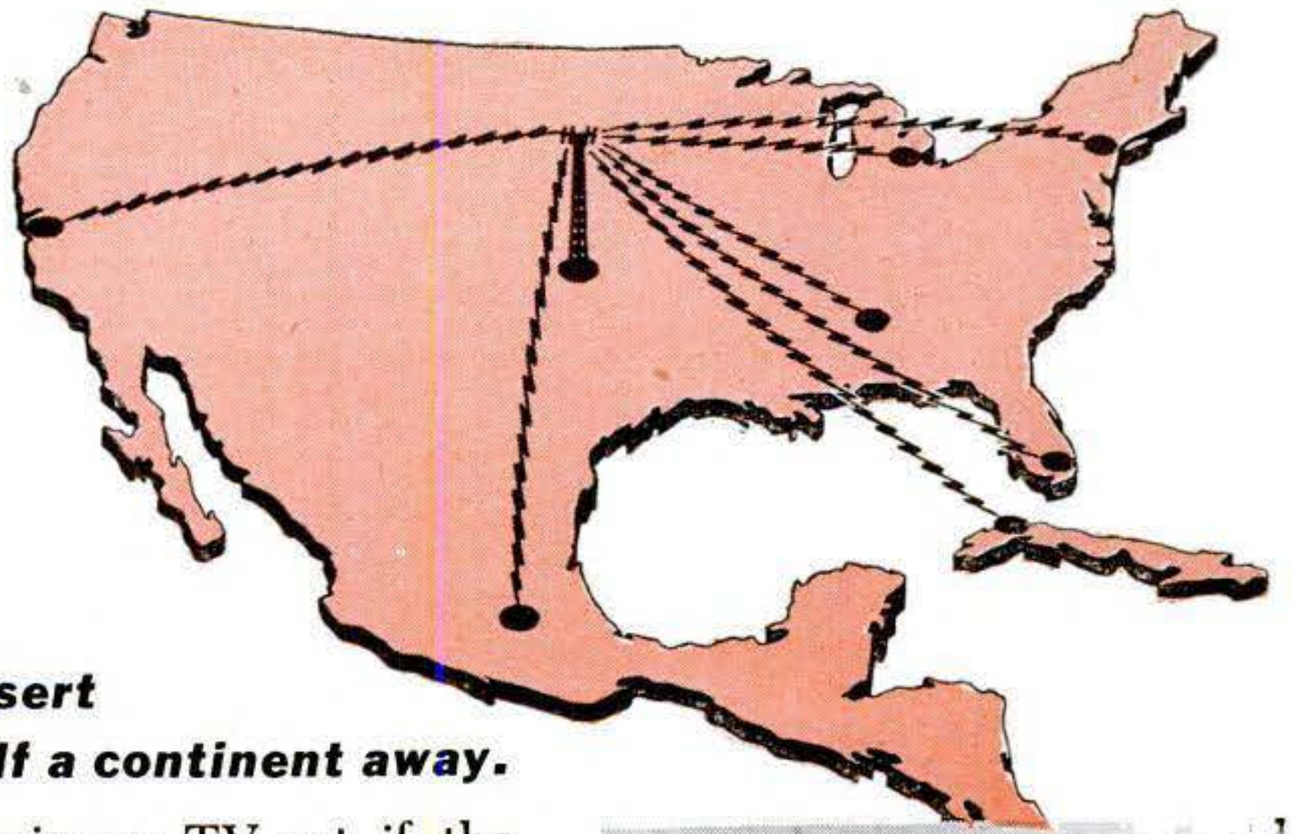
THIS COMBINATION—Gene Smith and his 16-incher—makes TV history in the heart of Kansas. Four-tube booster on set steps up signal from booster under antenna.

Kansas TV Fan Gets Both Coasts



De luxe rig set up in television desert has logged stations more than half a continent away.

YOU might think twice about buying a TV set if the nearest station is more than 200 miles away. Gene Smith, living in Hoisington, Kan., ordered a 25-tuber with a 16″ screen and hooked it to an antenna 30′ high. He didn't get a thing.

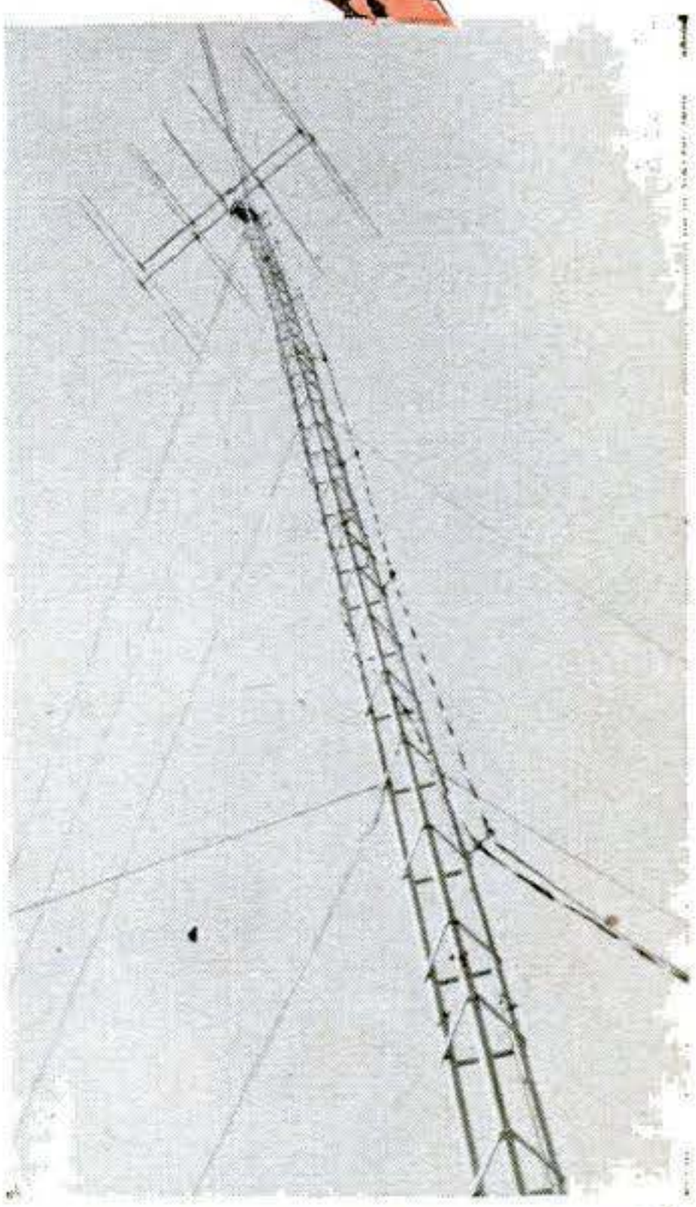
Undaunted, he ordered a one-tube booster, an antenna rotator and a five-element Yagi antenna cut for channel 4. This gave him sound once in a while, but no picture.

Then he moved to Great Bend, Kan., 10 miles away. He put his antenna on a 60′ mast, hooked the one-tube booster directly below it to amplify the signal ahead of lead-in pickup, and attached a four-tube booster to the set.

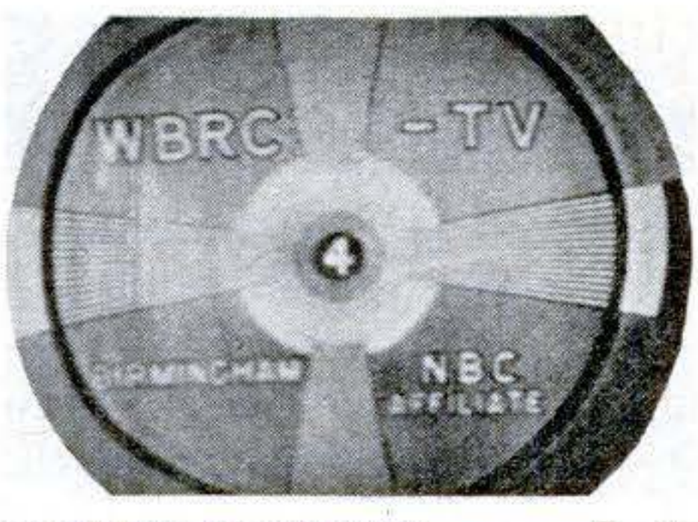
This equipment, which cost him a total of $650, has since brought in 22 stations, including WBRC-TV, Birmingham, Ala. (750 miles), WWJ-TV, Detroit (900 miles), KRON-TV San Francisco (1,280 miles), WNBT, New York (1,300 miles) and XH-TV, Mexico City (1,300 miles).

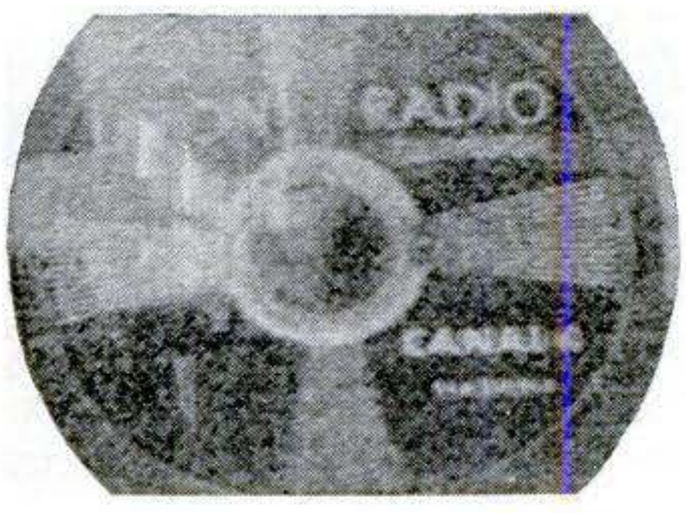
Smith is proudest of receiving Havana, Cuba, 1,550 miles away. It was clear for 12 minutes. Other far-distant stations have stayed on screen from one minute to an hour.

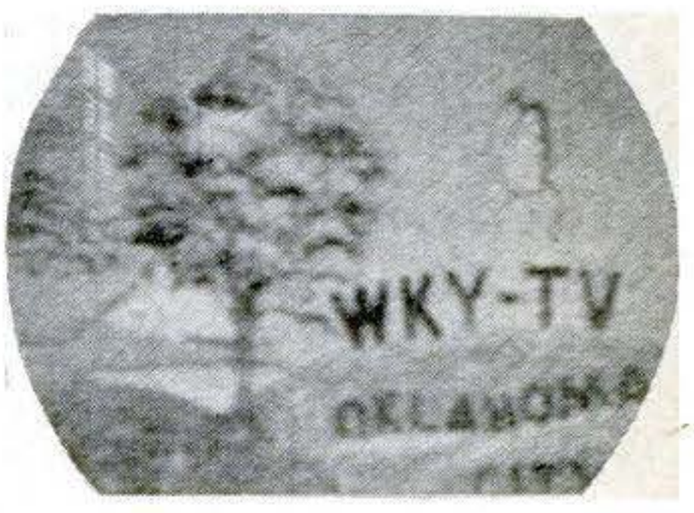
His unusual reception, Smith believes, results from an ideal location on high ground as well as his extra-sensitive rig. Weather has no predictable effect, but the best times to fish for DX appear to be before noon, in early evening and from 10 p.m. to midnight.



ANTENNA 60′ up is "fished" with a rotator to search out elusive signals. Twisted 300-ohm ribbon transmits signal from one-tube booster at top.







PHOTOS OF SCREEN prove Smith gets distance. Birmingham, Ala., station (left) is 750 miles away. Union Radio, Havana, Cuba (center) is 1,550 miles distant. "Local" stations like WKY-TV (right), only 225 miles off, come in regularly enough for programs to be enjoyed.

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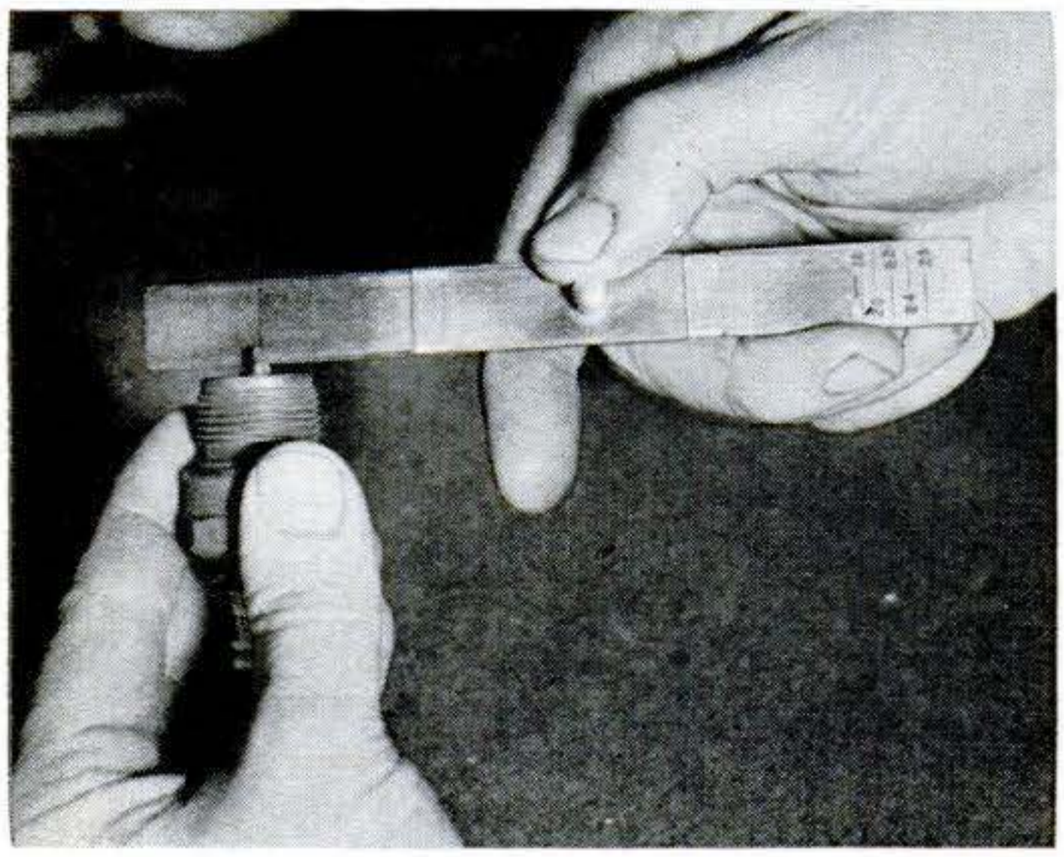
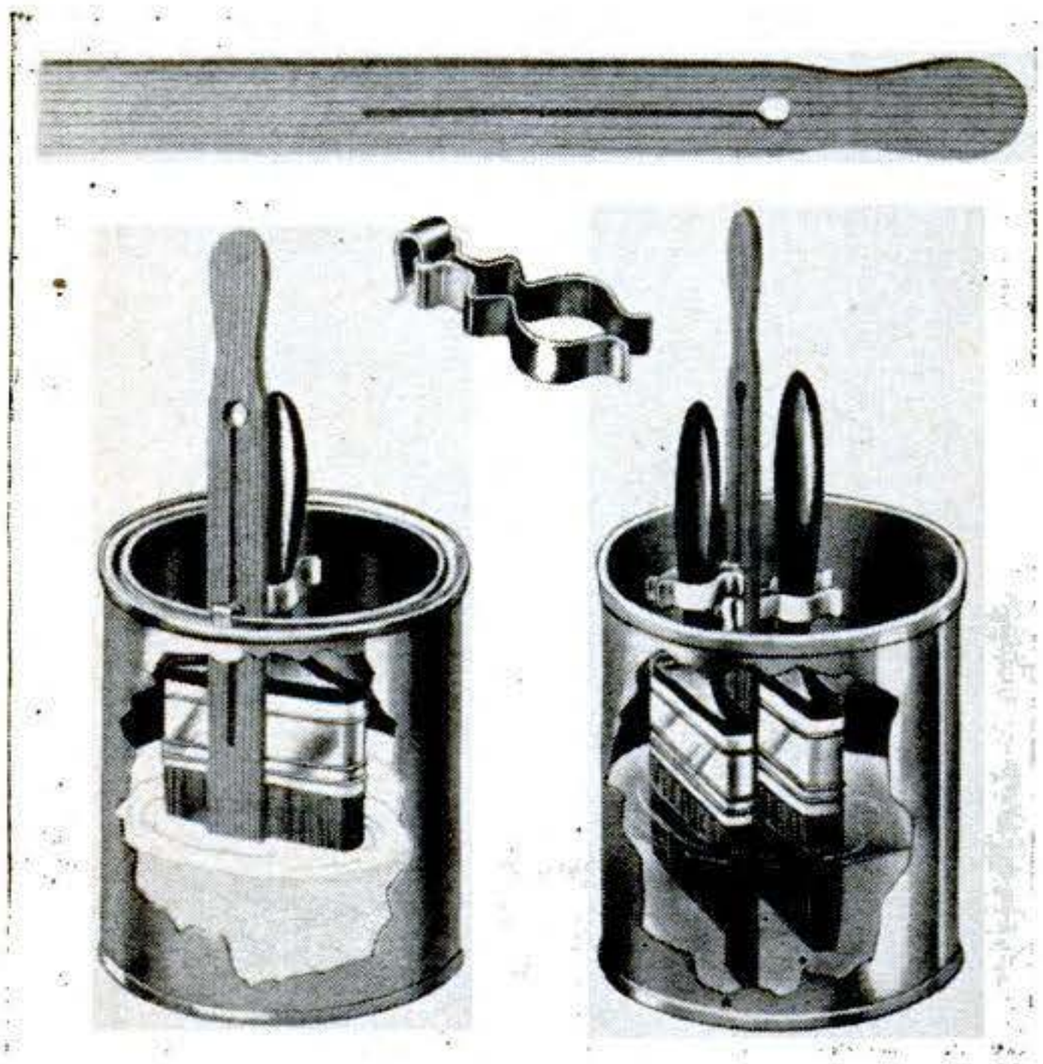
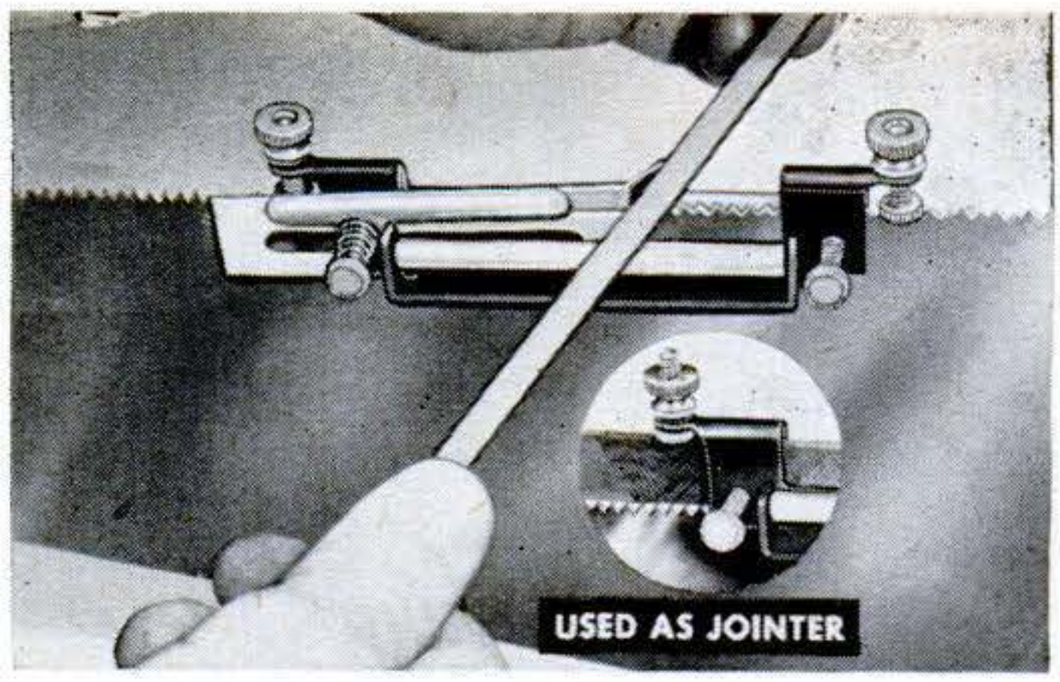
New Tools



1 Thickness Gauge Has One Leaf. Although this gauge has only one leaf, it will measure from .002″ to .026″. In use, the tapered leaf (shown between electrodes of a spark plug) is slipped into the opening to be measured as far as it will go. Then the sliding pointer blade is moved until it touches the end of the gap being measured. The reading is taken at the other end of the pointer blade. The gauge is made of hardened steel.

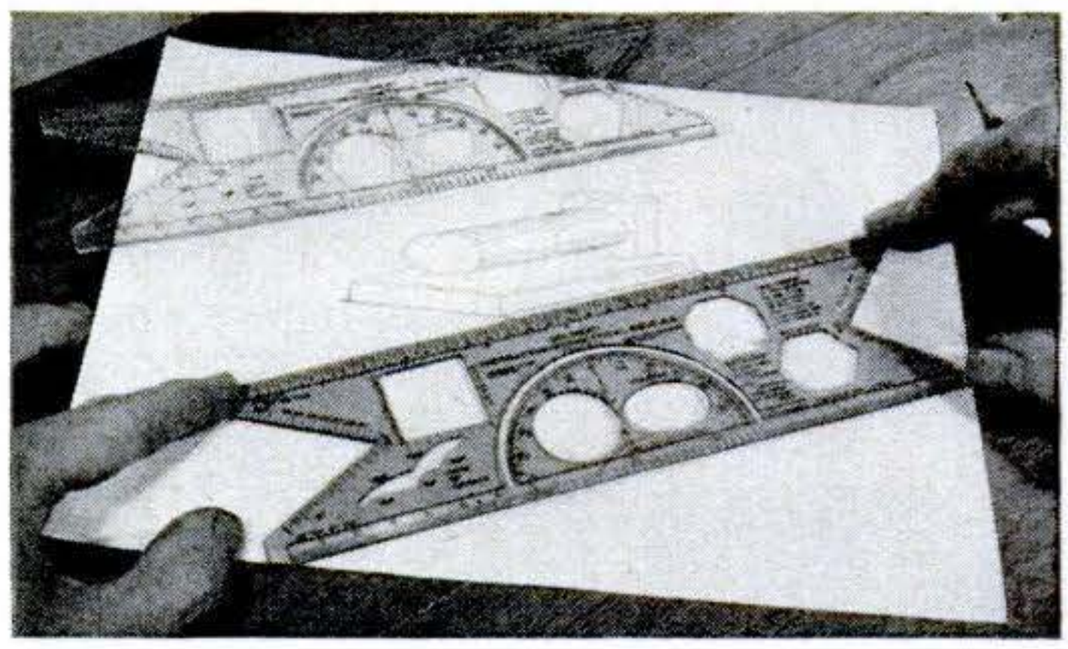


2 Stirrer Holds Paintbrushes. Brushes can be suspended in paint or cleaning solvent with this gadget. It holds brushes above the bottom of the can, keeping the bristles straight. The clamp may be moved up or down the stirring stick to suit brushes of different sizes.



3 Jig Sharpens and Joints Saws. Setscrews hold this jig to the saw blade, and two steel rollers limit the depth of cut that is made with the file. The jig is equipped with a depth adjustment and a bevel guide. The guide keeps the file at the correct sharpening angle. With a mill file clamped in the jig, the tool can be used as a jointer to even up the tips of the teeth.

4 Gas Sprays Paint. Carbon dioxide cartridges, the kind you can buy in most drugstores to carbonate beverages, supply the pressure for this paint spray gun. A cartridge is loaded in the handle and the trigger meters the gas as needed. One cartridge will spray as much as 21 ounces of thin paints, correspondingly less of heavier liquids.



5 Fourteen Instruments in One. Made of noninflammable transparent plastic, this drawing tool combines a protractor, four rulers, guides for drawing eight common geometric shapes, and a guide for drawing circles up to 8″ in diameter. Arcs of various radiuses also can be made.

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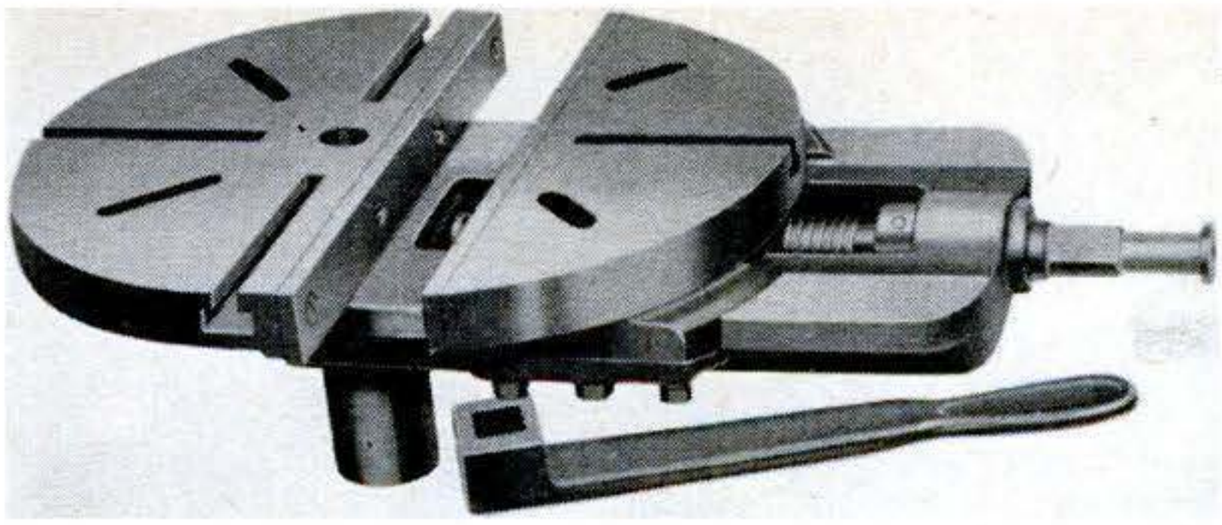
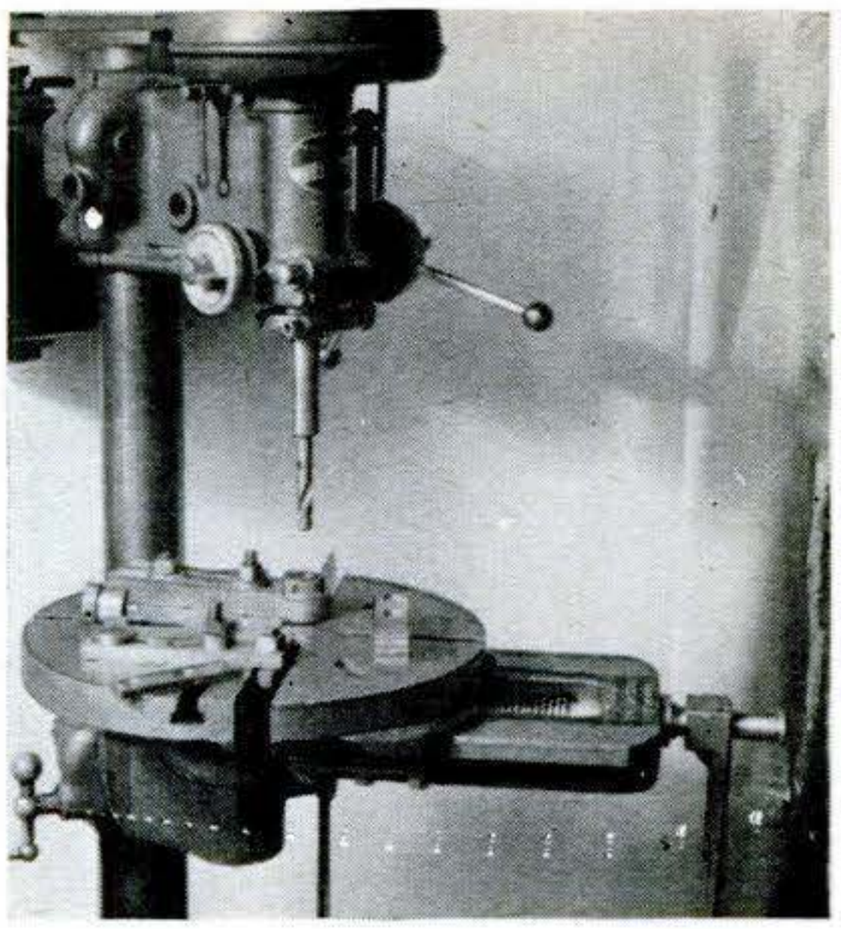
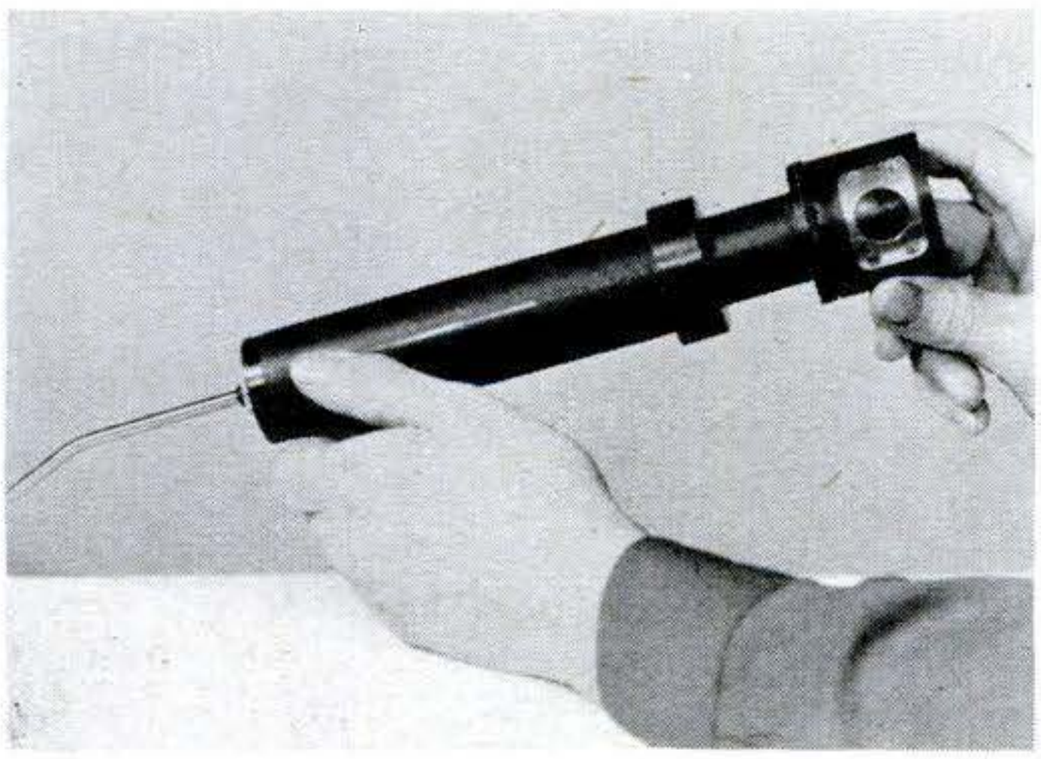


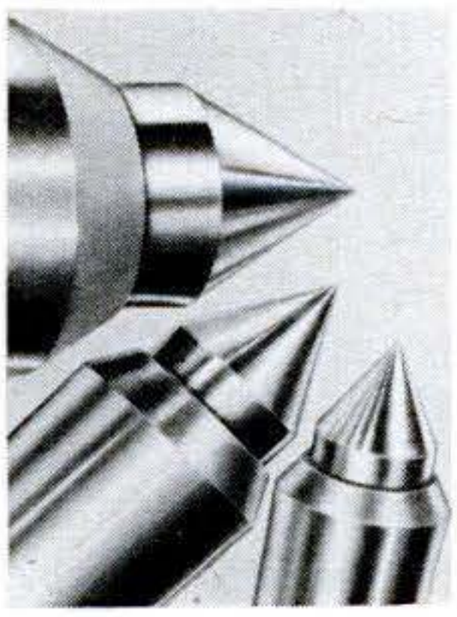


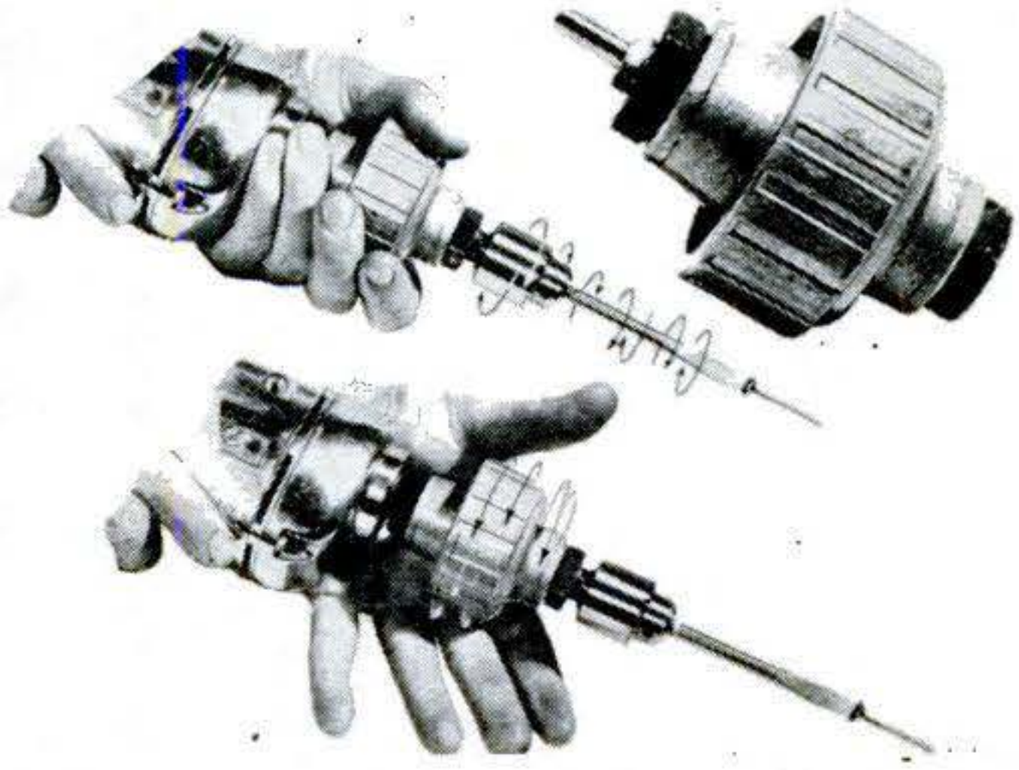
6 Vise Built into Drill-Press Table. Designed to replace a standard drill-press table, this combination model includes a vise and a set of parallels. Round stock can be held in the vise and other shapes can be bolted to the slots for a variety of setups.



7 Air Gun Operated by Hand. Chips, shavings and dust can be blown out of hard-to-get-at spots in machinery with this hand-powered air gun. An added feature is a flashlight built into the handle for inspections in badly lighted places. The Wind Mill is made of laminated phenolic plastic.

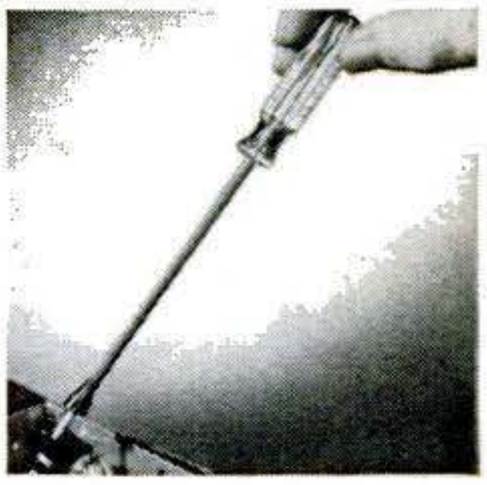
8 Lathe Centers Use Jet-Engine Alloy. Exmet, a new alloy developed to take the high speeds and temperatures of jet engines, now is being used to make dead centers for lathes. According to the makers, these centers have run for weeks without regrinding on jobs that normally require new high-speed steel centers after just a single day.





9 Hand Clutch for ¼" Drill. Tools start and stop instantly with this 5-to-1 speed reducer. You just grip the reducer and the tool operates; release it and the tool stops and the reducer revolves freely. It has a planetary-gear system instead of a friction clutch, and the 5-to-1 reduction lets you drive screws, drill concrete and do other jobs that require high torque at low speed. It can be mounted on the spindle or in the chuck.

10 Nut and Screw Starter. A spring in the end of the shank holds a screw or nut until it can be started. After a few turns, the tool releases itself and pulls free. It has a Tenite plastic handle and comes in sizes to take nuts or screwheads from 3/16" to 7/16".



These tools are made by: 1. Rinck-McIlwaine, Inc., 16 Hudson St., NYC; 2. Progressive Enterprises, 5533 S. Western Avenue, Los Angeles 62; 3. A. D. McBurney, 317 E. 4th St., Los Angeles 13; 4. Sullivan-Becker Machine Co., 6705 14th Ave., Kenosha, Wis.; 5. Britain Products Co., 380 E. Exchange St., Akron; 6. Modern Machine Tool Co., Jackson, Mich.; 7. Air Line Mfg. Co., Box 18, Indianapolis; 8. DoAll Co., Des Plaines, Ill.; 9. Babcock & Co., 6253 Claremont Ave., Oakland 18, Calif.; 10. Kenneth D. Clayson, Box 1032, Bethlehem, Pa.

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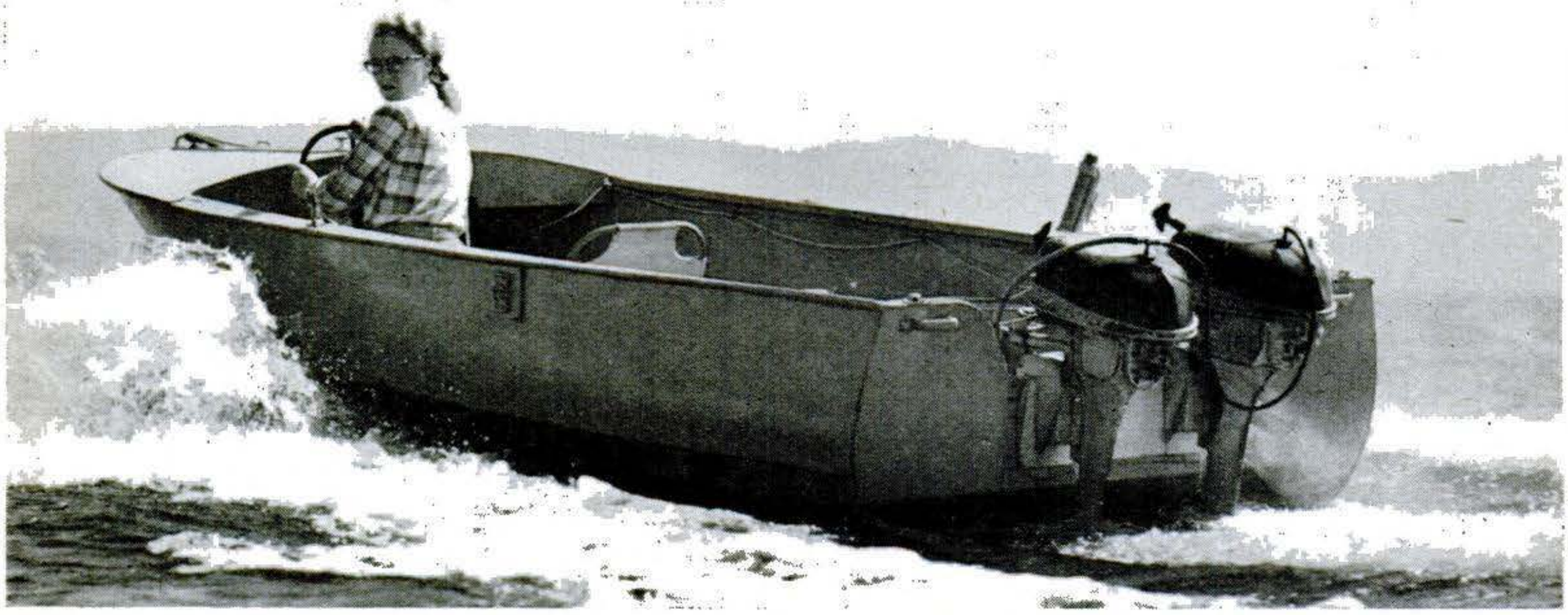


HEADING OUT TO SEA, twin-motored craft is sure of a safe return, since it can get back to port on one motor. Molded-plywood hull is 16′ long with 5′10″ beam. Weight is 450 lb.

Twin Motors Can Make Outboard Safer

A pair of power plants will cut down on the risks of deep-water fishing trips.

LET'S suppose you're fishing 20 miles off shore in a 16′ open boat. There's a husky outboard motor clamped on the transom, and suddenly it conks out. There's no hope of a baling-wire fix. You're stuck.

But if you have two medium-sized motors on the transom instead of a single husky one, you're in the clear. The remaining motor will see you home. This is why Dr. Van A. Odle is a twin-motor fan. When he and his wife leave their home on Balboa Island, Calif., for a 20- or 30-mile fishing trip on the Pacific, they have a pair of 10-hp. motors on their boat. When the weather looks right, they make jaunts that might be foolhardy in a single-engine craft.

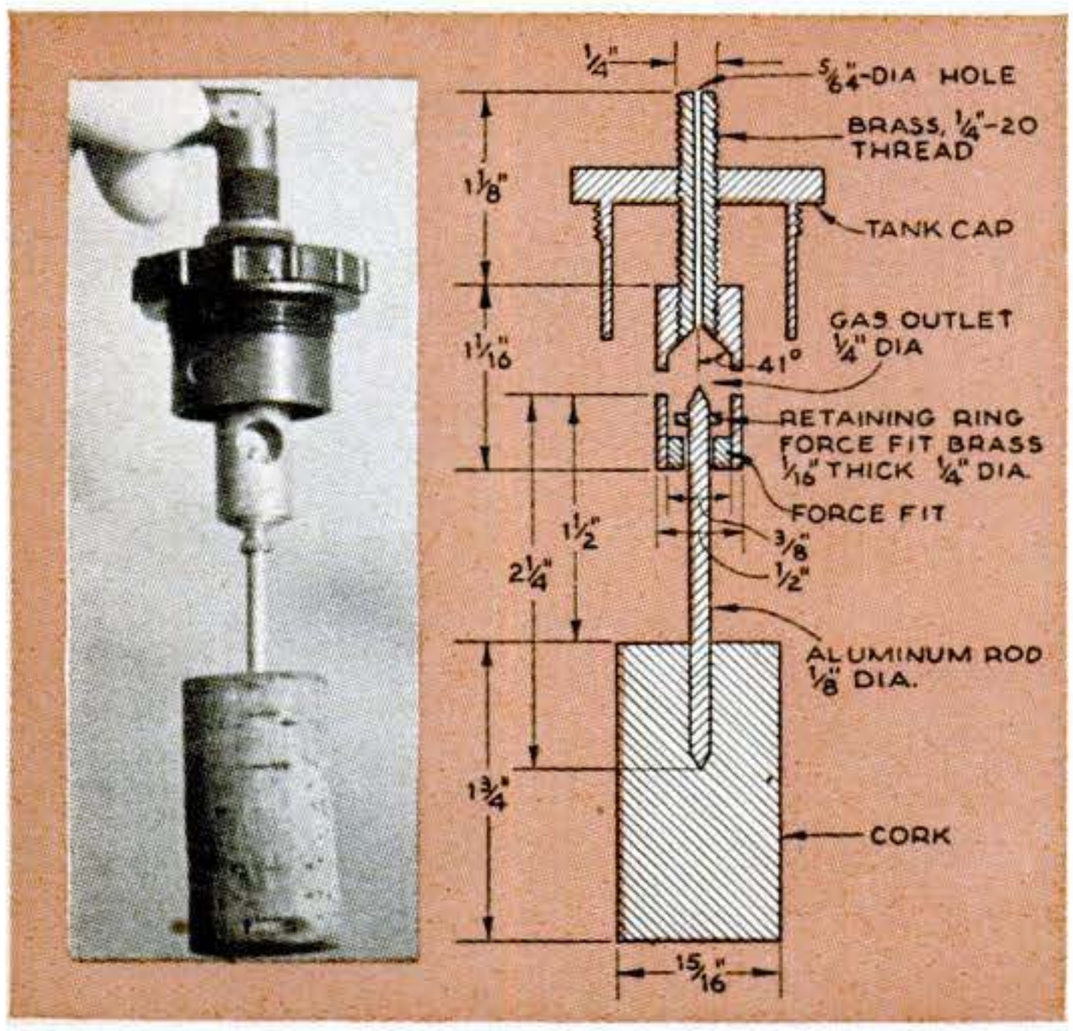
Two Motors Pose Problems

Steering and throttle control of two motors from the wheel were two problems to solve. A third was fueling the motors on the open sea from a 21-gal. auxiliary tank.

The motors, unlike some of the newer models, are not equipped with fuel pumps to draw gas out of the auxiliary tank, so air pressure was used to force fuel back from the bow tank to the motors.

One drawback to this system is that it's very difficult to provide just the right amount of air. A couple of extra strokes on the pump will overflow the motor tanks, slopping gas over and fouling the motors.

Dr. Odle stopped this by building a float valve for each motor tank. He used the same gas-tank caps, but replaced the vent screws with homemade valves operated by cork floats. The corks cut off the supply of gas



FLOAT VALVES maintain constant fuel level in motors' tanks. Corks float up or down to shut off or open valves in line from bow tank.

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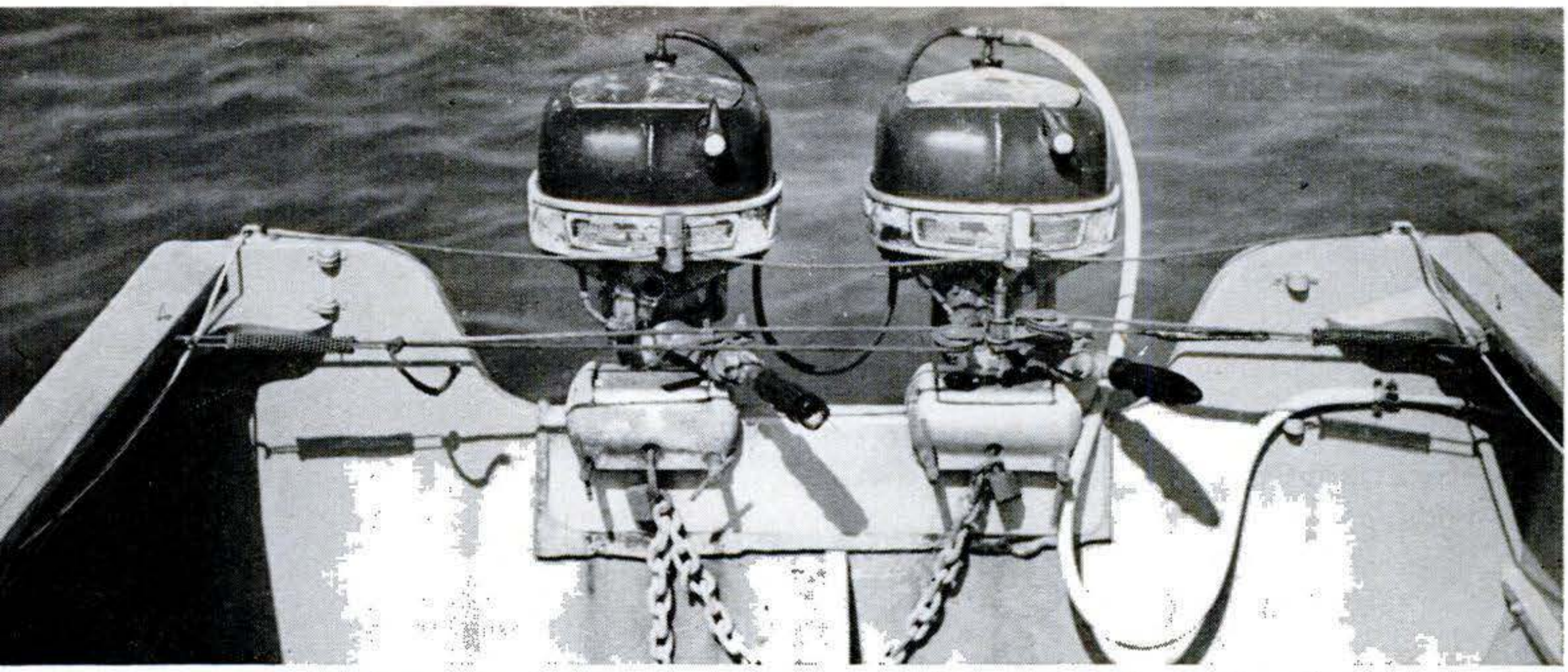


STEERING LINES **from wheel run to one motor. Other motor remains fixed, since only one is needed to steer boat. Details of twin-pulley arrangement for steering are shown below.**

when the motor tanks are about half full.

Copper tubing leads from the auxiliary tank to the stern. Flexible neoprene tubing runs from the end of the copper line to the motors themselves. A homemade three-way valve directs fuel to either or both motors, making it possible to cruise with one motor tilted up (when its float valve would of course be inoperative).

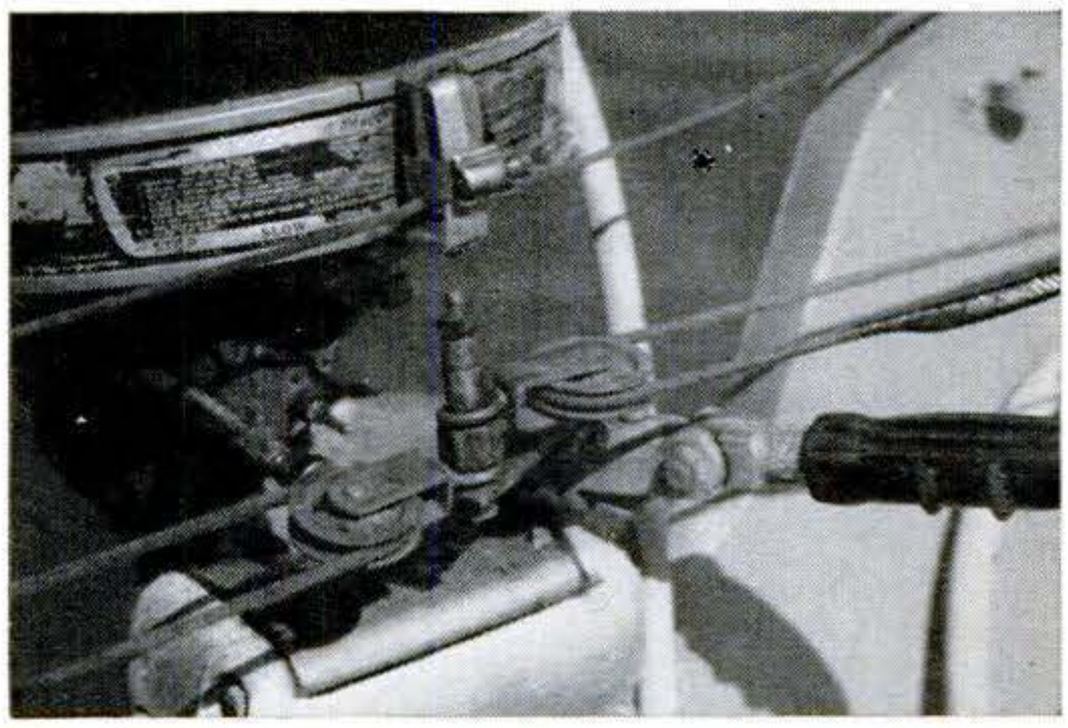
For simplicity Dr. Odle experimented with steering only one motor, leaving the other locked straight ahead. He found that one motor gave entirely adequate control. To retain the safety of having two independent power plants, he rigged the steering pulley so that it could be fastened to either motor's tiller.

The throttles are controlled by a continuous slack line that circles the inside of the cockpit. This arrangement has one drawback. Since just one motor pivots, the throttles are thrown out of synchronism during a sharp turn. This could be avoided by rigging independent throttle controls.

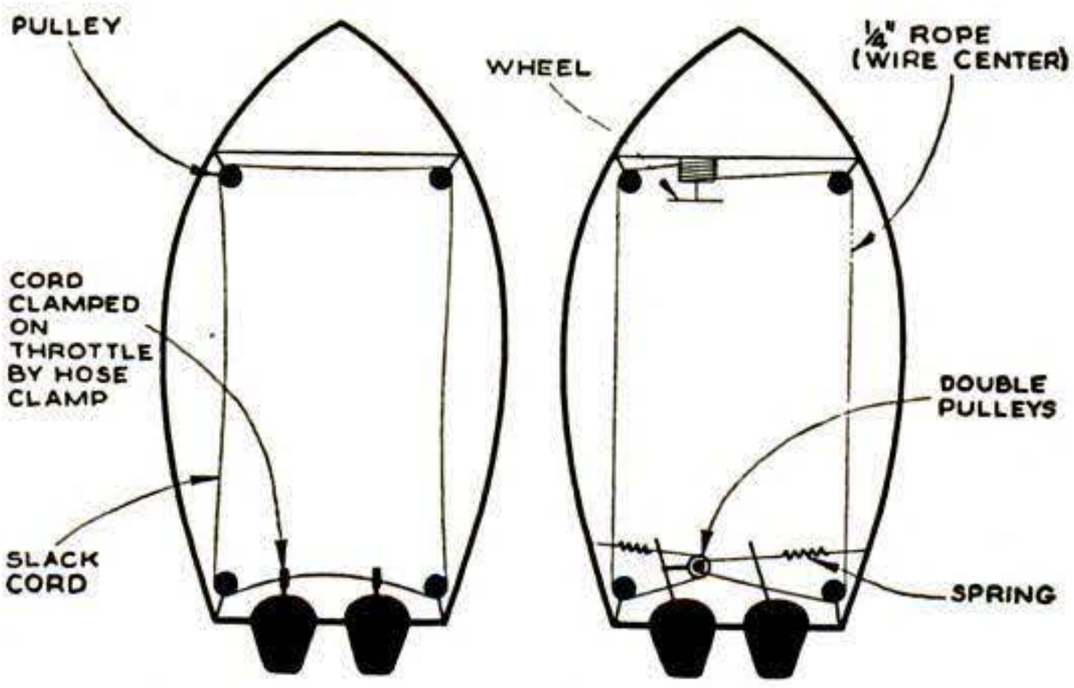
Two Motors vs. One

It is generally conceded that one big motor is more efficient than two smaller ones that total about the same power. But as Dr. Odle sees it, the safety factor offsets this.

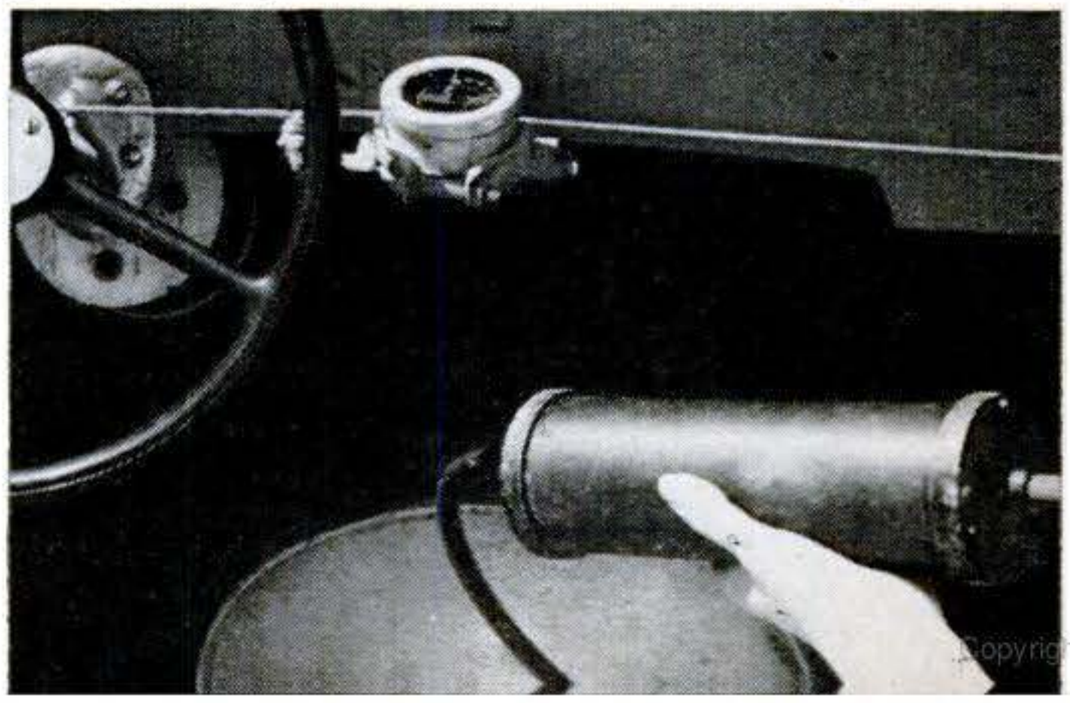
The efficiency loss may be largely theoretical in his case, at that. Much of the time choppy water makes speeds over 10 m.p.h. uncomfortable, so he cuts one motor and tilts it up out of water. When sea conditions permit, both are operated, giving a top speed of about 23 m.p.h. END



CONTROL LINES **for throttles and steering are shown above and diagramed below. Line is attached to throttles with hose clamps.**



AIR PRESSURE **for bow tank is supplied by hand pump below. Three or four strokes on pump every 30 minutes maintain air pressure.**



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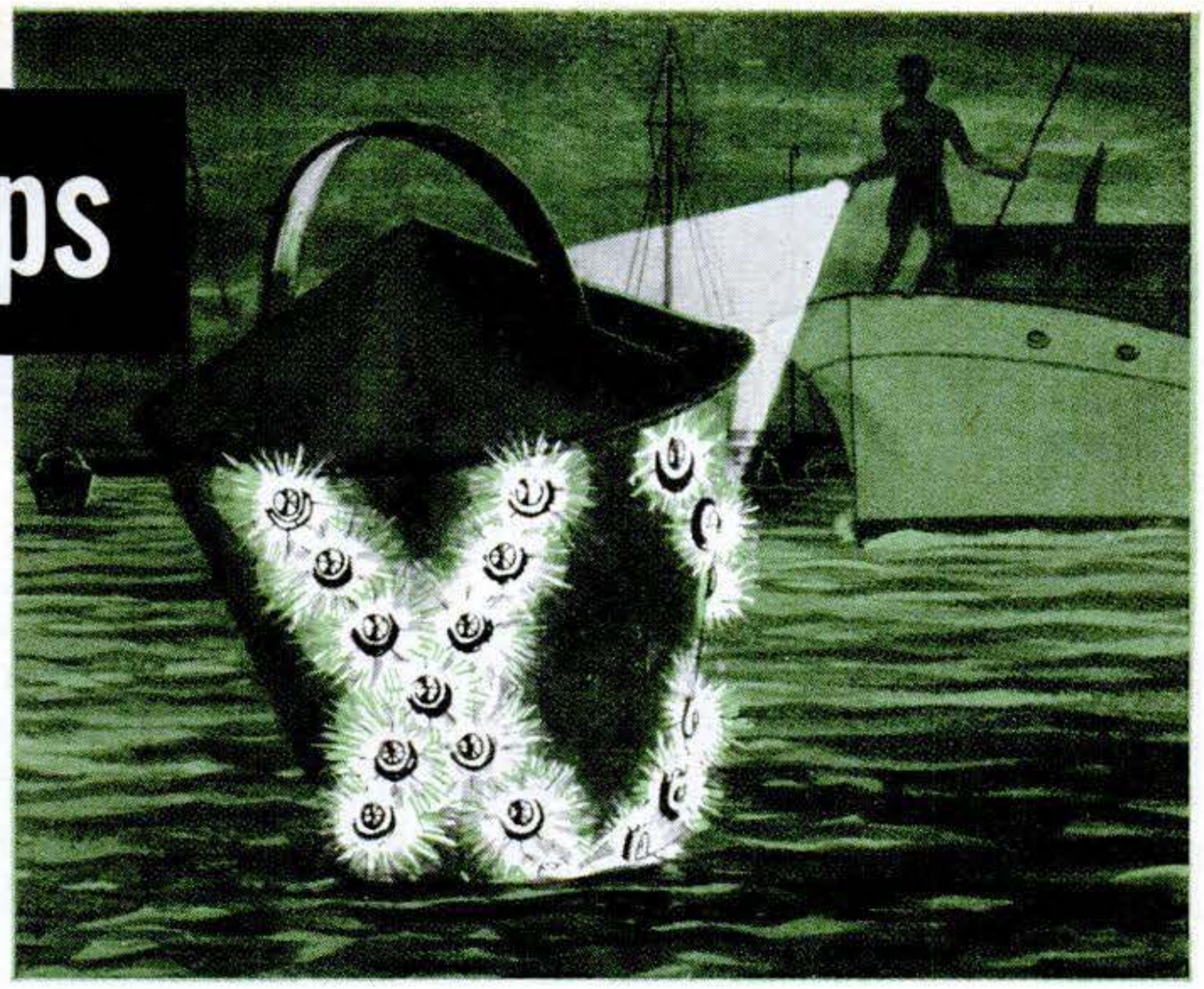
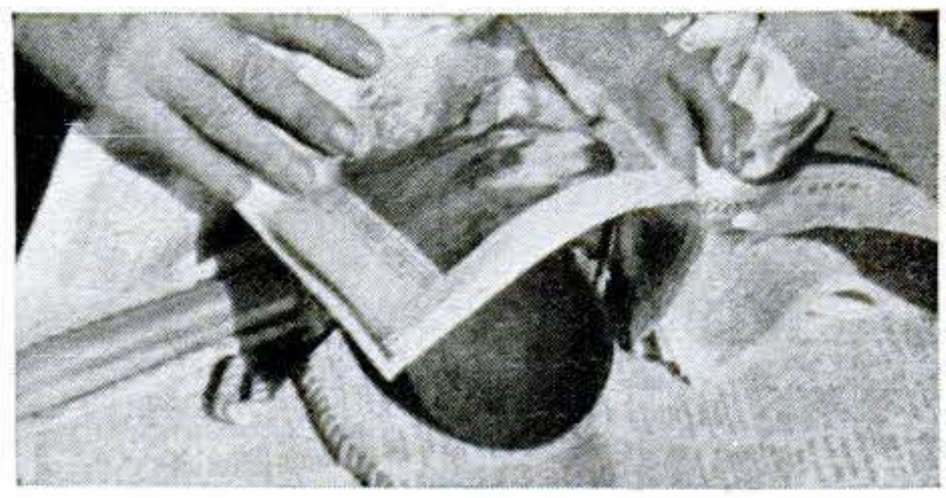
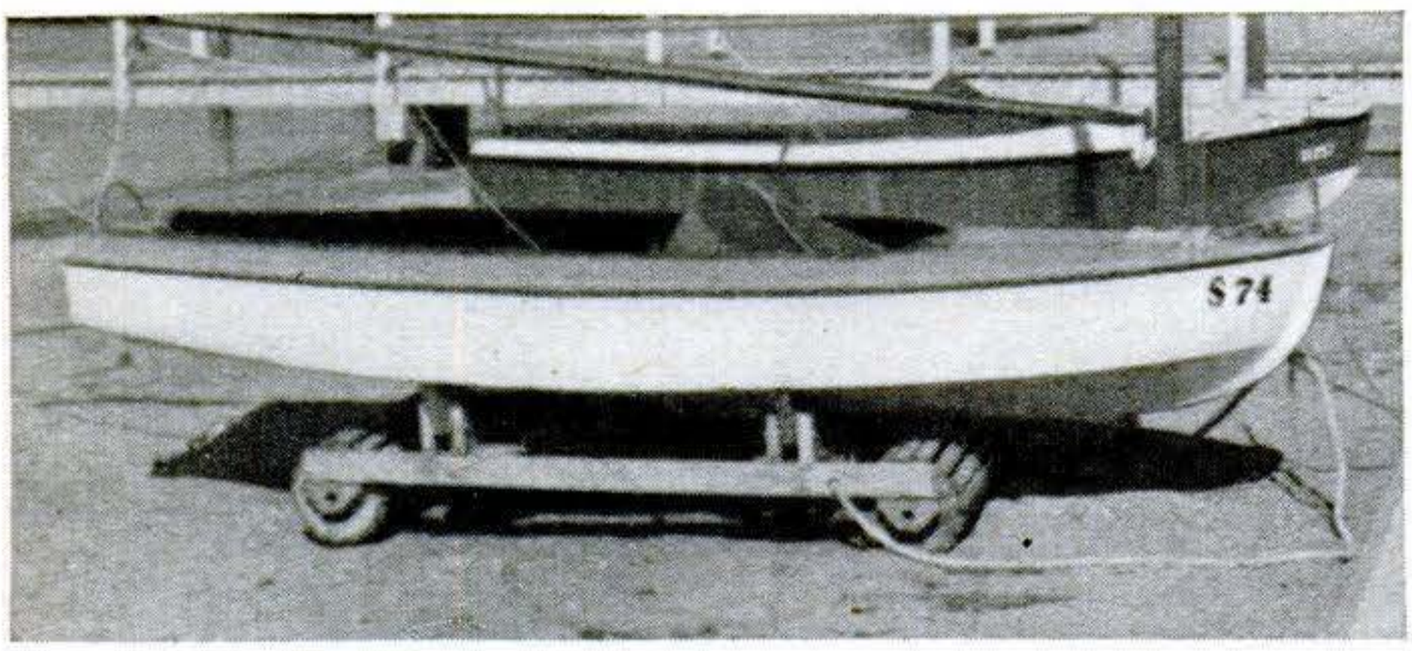
Boating Tips



Reflectors Spot Buoy. You'll be able to pick up your buoy even at night in a crowded harbor if you cement glass reflector "jewels" to it in a distinctive pattern. The pattern will leap out of the darkness as the beam of your spotlight sweeps it.

How to Store Boat-Carrier Suction Cups. When the vacuum cups of an auto-top boat carrier are not in use, wrap them loosely in newspaper and store them in a cool, shaded place. If the cup surfaces become slightly hardened, sand them lightly with a fine abrasive paper or cloth. Then wipe them with castor oil. Wipe off the oil before using them.





Beach Dolly Rolls on Sand. Launching or beaching a boat is a snap with a dolly like this. The wide rollers, made of one-by-twos nailed to 2″ by 12″ wood disks, won't sink into the sand like trailer wheels. The side members are two-by-sixes with a one-by-four cross brace. The cradle supports are made of one-by-six stock, and the cradles are two-by-sixes pivoted on ½″ galvanized bolts. Pivoting the cradles lets them conform to the hull, distributing the load evenly and permitting the dolly to carry different boats. *—C. R. Hull, Costa Mesa, Calif.*

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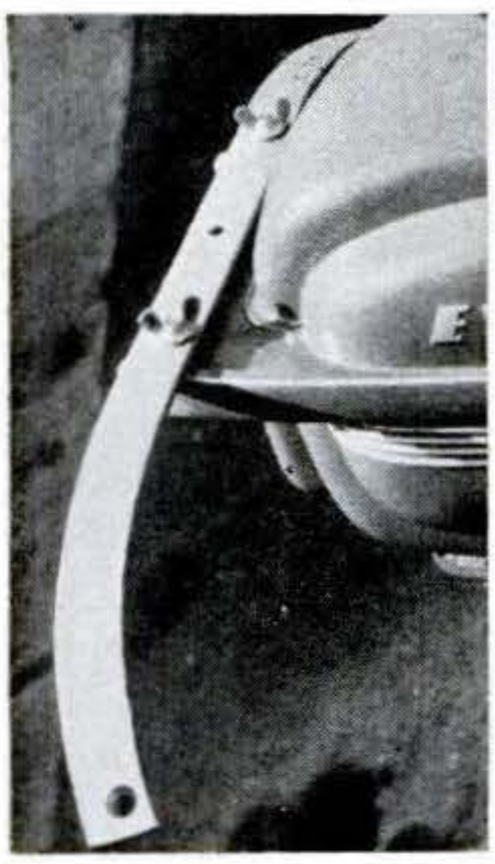
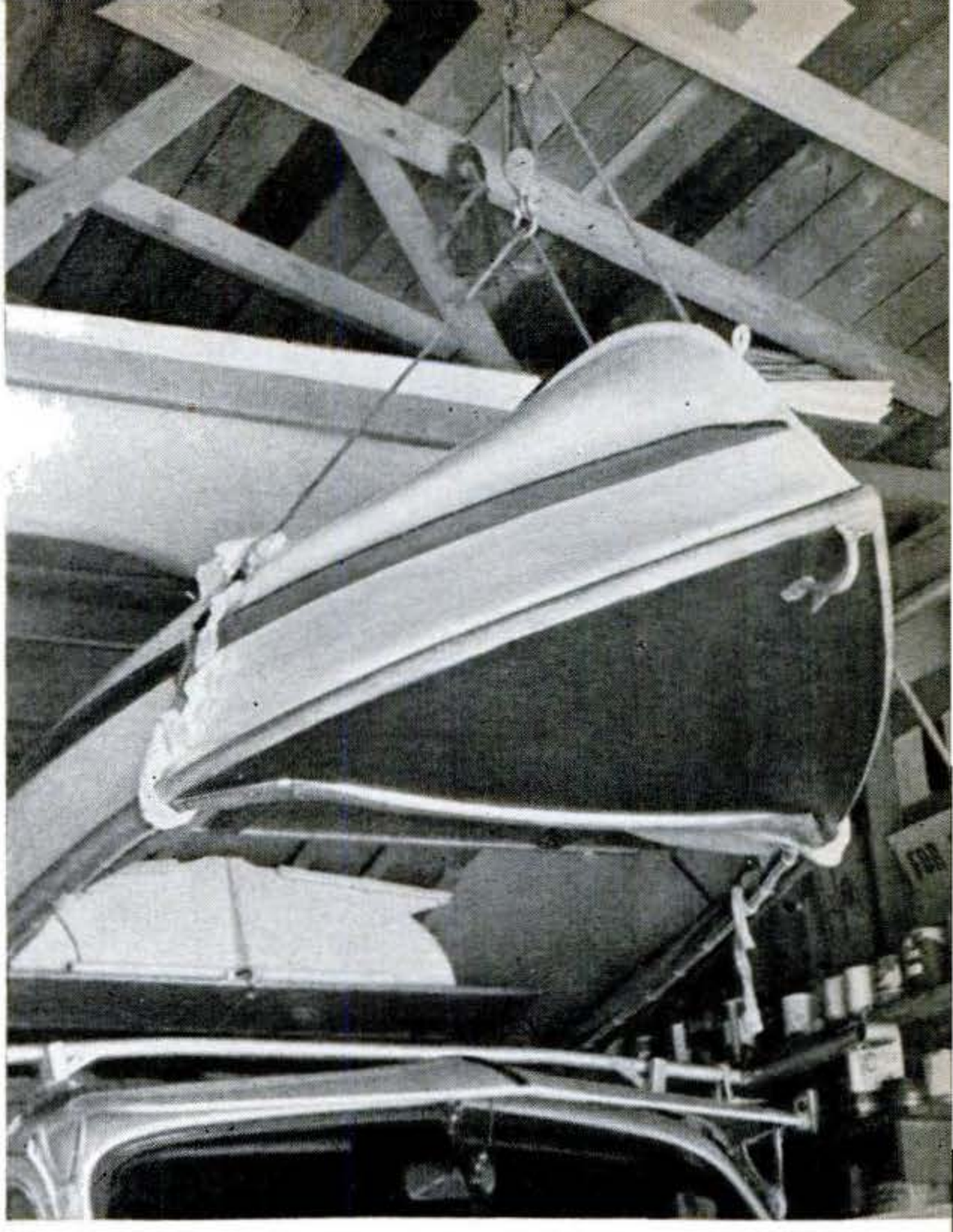
Plastic Skylight Lights Cabin. Rainy weather means battened hatches and dark, stuffy cabins. Sawed from ¼″ Lucite or Plexiglas, this skylight can be slid in place to let in light, and its projecting lip allows the door to be left open for air.

Steering Arm Quickly Removed. I only have to unscrew two thumb nuts to remove the steering arm when I want to carry my outboard motor in the car trunk. I drilled and tapped two 5/16″ holes through the web of the motor housing and inserted 5/16″ by 1¼″ brass machine screws. Matching holes were drilled in the steering arm. To keep from losing the washers, I soldered them to the wing nuts. *—Clinton R. Hull, Costa Mesa, Calif.*





Boat Stored Under Garage Roof. With two sets of block and tackle, four iron hooks and some ½″ line, you can store a small boat under the roof in many garages. Bend the hooks from ½″ iron rod and wrap them with cloth so they won't mar the boat's finish. When you are ready to haul the boat up, space the hooks so that the two pairs divide the hull into thirds. This method of storage is especially handy if the boat is carried on top of a car.

Safety Pins for Rowlocks. Heavy galvanized or copper wire or ⅛″ bronze brazing rod can be bent to form safety pins for rowlocks. Such pins will keep the rowlocks from accidentally lifting out of the sockets.

Boat Table for Rough Weather. The recessed box built into this table has removable partitions that form various-size compartments. These hold utensils and food containers upright in heavy seas. A solid panel fits over the recess to reconvert it into a standard table.—*W. F. Buehr, N.Y.C.*

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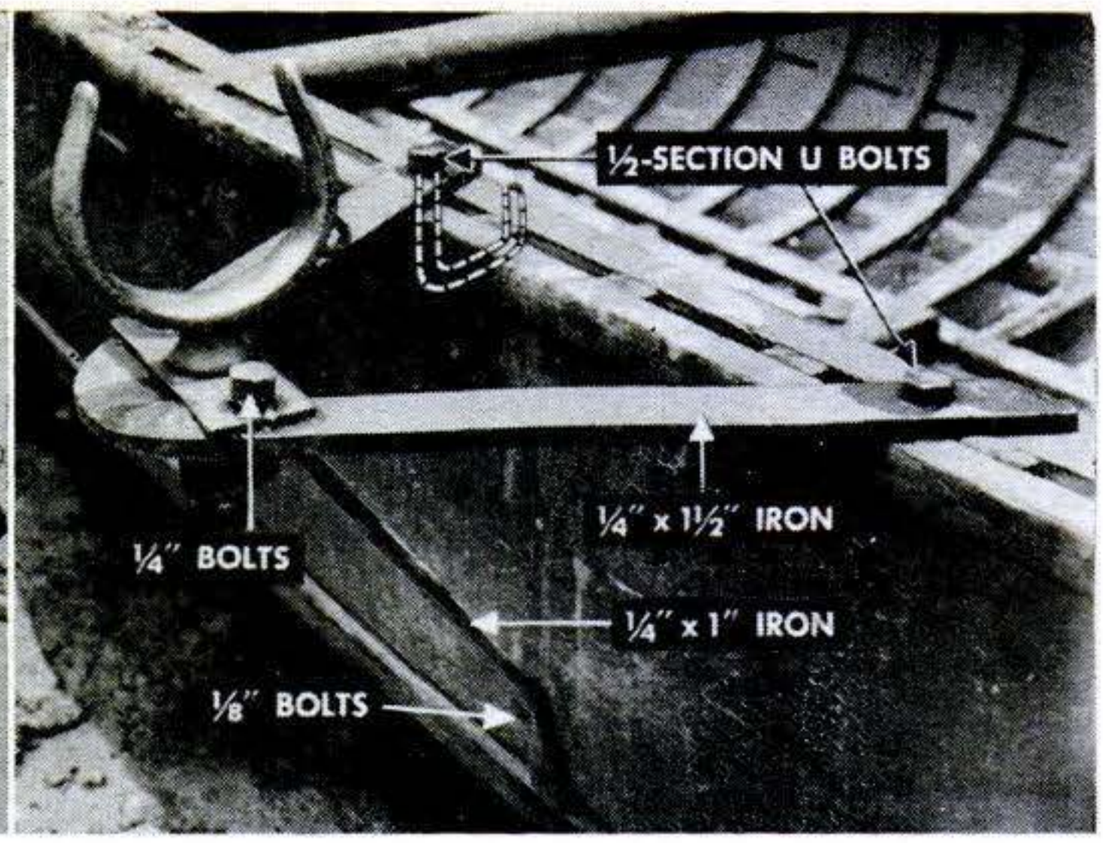
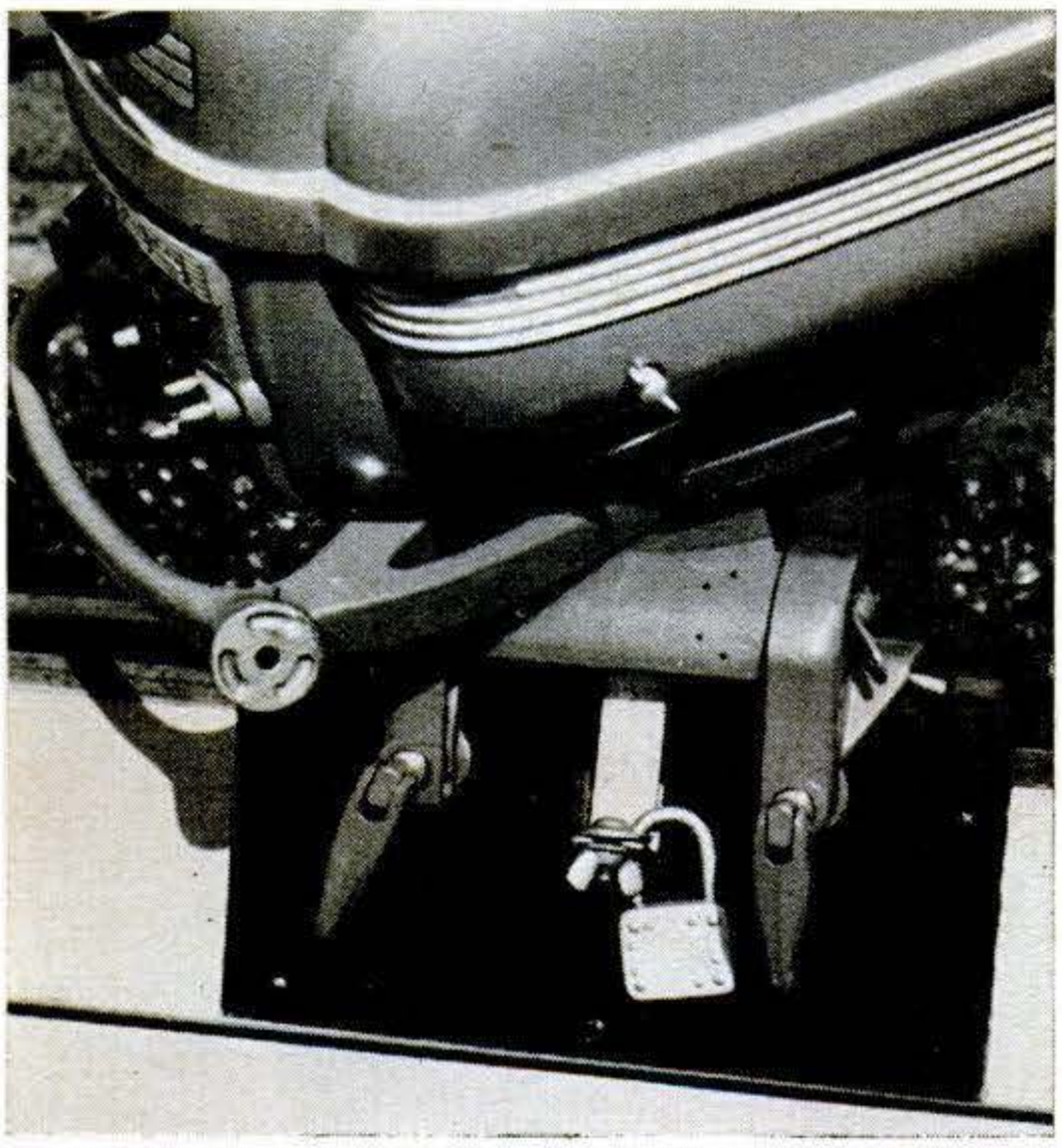
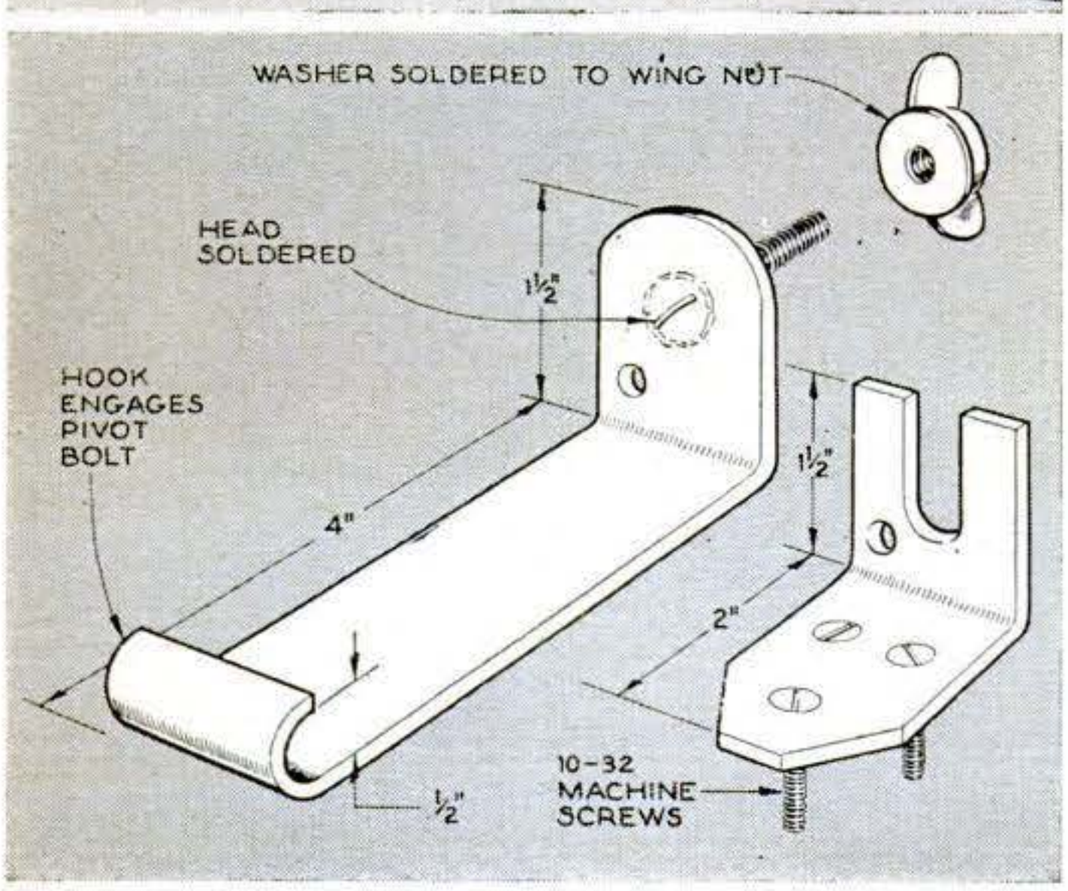


Outrigger Oars Increase Canoe's Speed and Maneuverability

EQUIPPING a canoe with outriggers and oars not only lets you make higher speed than you can by paddling, but also gives better control in strong winds. Locate the outriggers so that the rower will sit a little astern of the middle of the craft.

The ¼" by 1" support for each outrigger should be located to make the ⅛" bolt pass through one of the canoe's ribs and should meet the hull above the water line. Use heat to bend the outriggers and the U bolts.—*Emery G. Gregory, Reedsburg, Wis.*





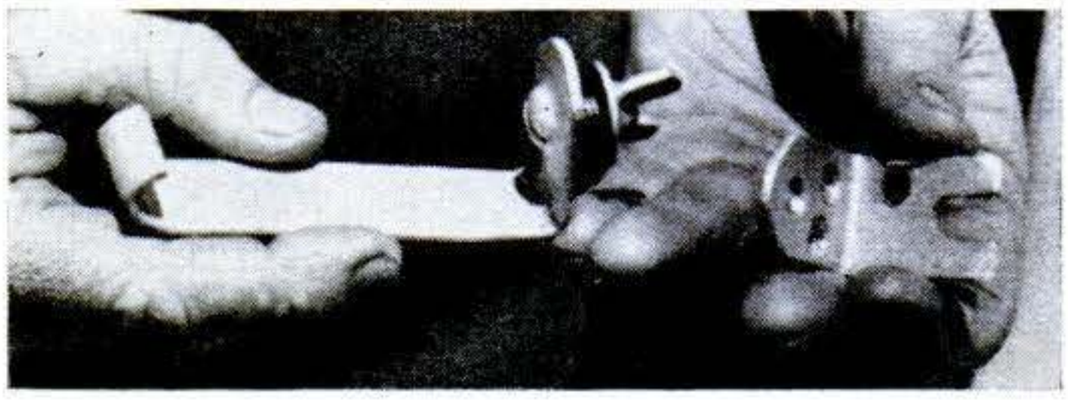
Guard Locks Outboard Motor

WITH this clamp-on guard, an outboard motor can't jump off the transom. It consists of two main parts: a hooked piece that fits over the bar on which the motor tilts, and a bracket mounted on the transom. A wing nut and bolt hold the two parts together, and a padlock by the nut discourages motor thieves.

Bend the two parts of the hold-down from 3/32" galvanized sheet iron. Use a hacksaw and file to slot the hooked part. Drill holes for the bolts, and also holes to suit the shackle of the padlock.

To mount the hold-down, put the motor on the transom and tighten the motor's mounting screws. Engage the hook on the tilt bar and locate the position of the bracket. Allow ⅛" clearance between the two parts for tension when the wing nut is tightened. On some transoms a spacer block may be needed under the bracket.

To use the safety clamp, set the motor in position with the hook over the pivot bar and tighten the wing nut. Then tighten the motor's mounting screws.—*Clinton R. Hull, Costa Mesa, Calif.*



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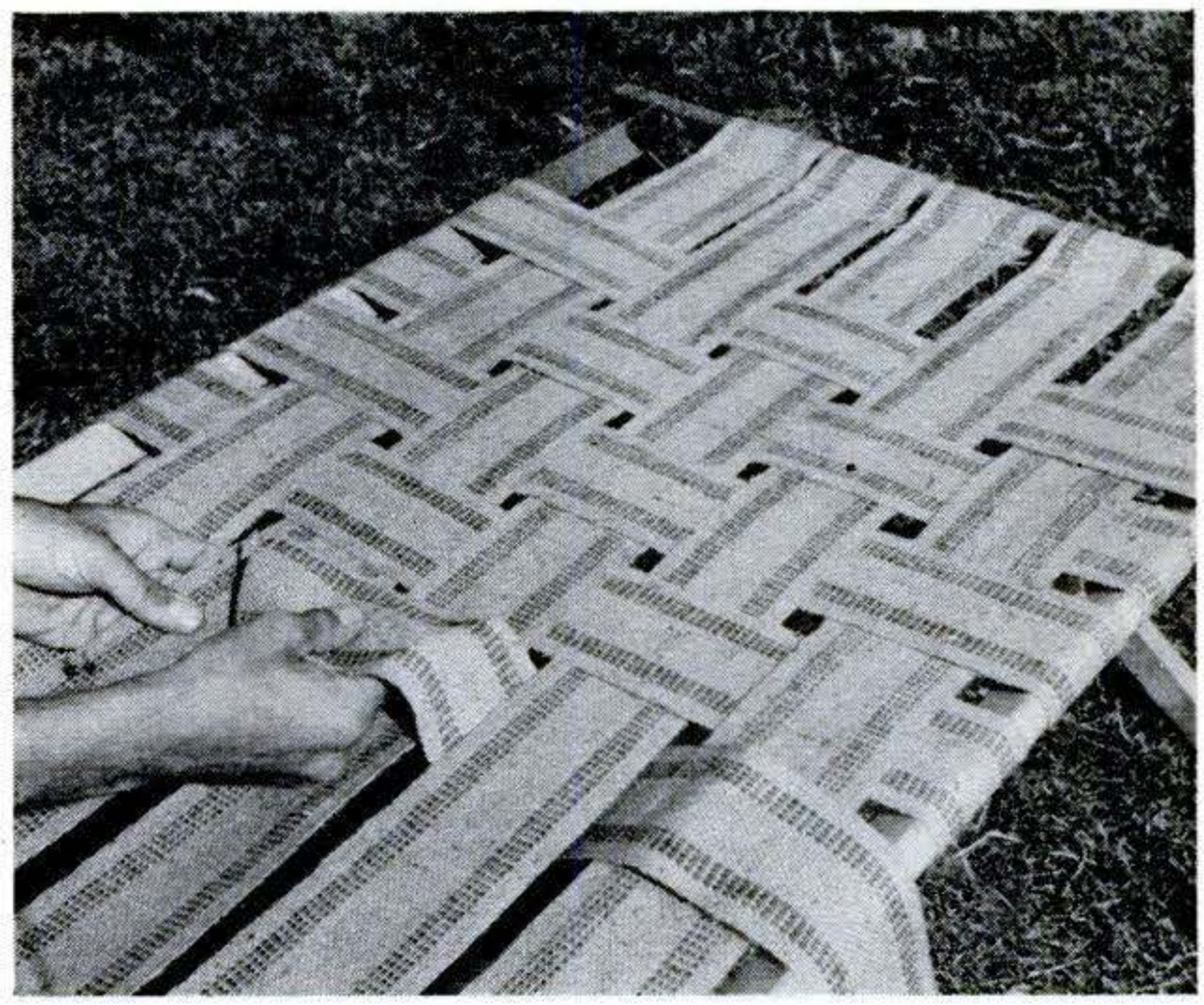
Webbing Strips Replace Canvas on Old Folding Camp Cot



IF THE canvas is ripped or stretched on that old camp cot but the frame is still good, it's worth recovering. Upholsterer's webbing used in place of canvas makes a rugged, good-looking camp bed.

You will need about 24 yards of webbing, some tacks, a darning needle and tough string or fishing line. Remove the old canvas, stretch a piece of webbing the full length of the cot and stitch loose loops around the end bars. Double each end of the fabric so the darning string goes through three thicknesses.

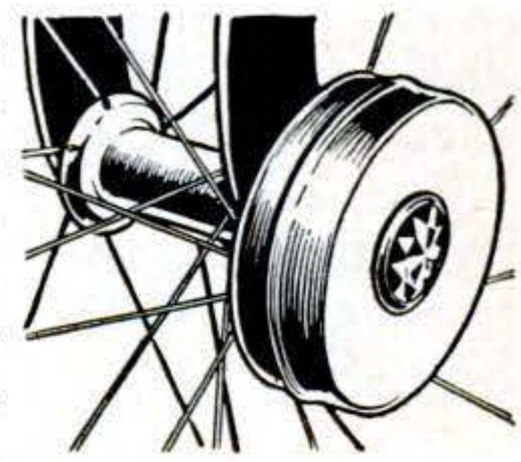
Sew in five such lengthwise strips and then weave cross strips under and over them. Double the ends and tack them under the frame sides where you can. Where tacked webbing would interfere with folding parts, use shorter cross strips and stitch them to the lengthwise ones.

The renovating job won't cost you much. I bought upholsterer's webbing for 13 cents a yard.—*Warren Asa, Pana, Ill.*

Soap Cupboard Built in Wall

HERE'S an easy way to store soap powder right next to the sink. The cupboard simply utilizes the space between two studs. Cut the opening high enough to take a giant-size box of soap flakes and nail two cleats to the studs at the bottom of the opening to hold a shelf. You can make the door of plywood or tongue-and-groove stock cleated together. A catch and knob complete the job. I didn't use a knob since this door fits flush with a window sill at the top.—*Jerry Parker, Sonoma, Calif.*

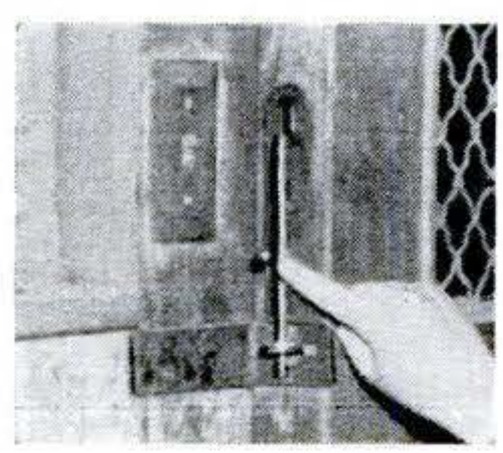
Bike Hub Caps Made from Cans



A BICYCLE can be dressed up to the juvenile eye with hub caps made from empty shoe-polish cans. Punch a ⅜″ hole in the bottom half of the can to fit it over the axle, and use the axle nut to clamp it in place. Punch a centered hole in the can lid to take a jeweled reflector or ornamented license-mounting bolt. Press the lid back on and coat the can with aluminum paint.

Lock for Barn Stalls Is Safe

THIS lock for stalls, used in the Mullins barn, North Lima, Ohio, can't be jarred open by accident. An ordinary barrel-type door bolt mounted vertically above a lock hasp does the trick. To lock, the slotted leaf is passed over the eye of the hasp. The bolt then is dropped down into the eye.—*John Krill, North Lima, Ohio.*



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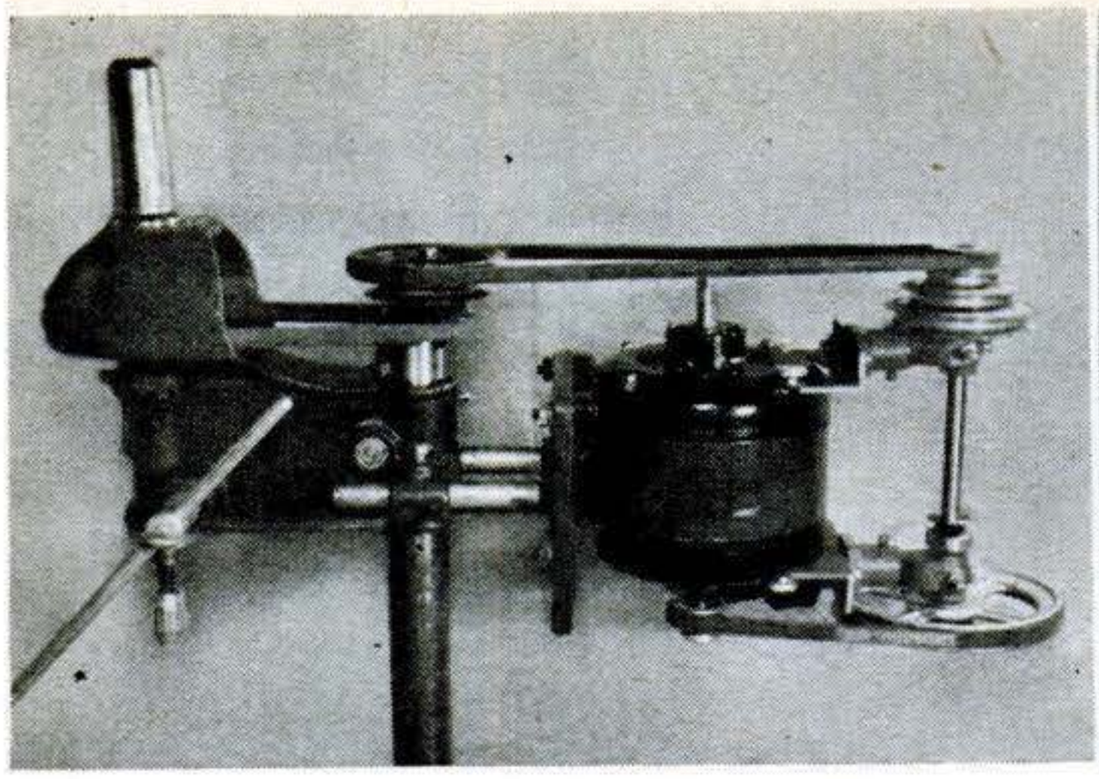
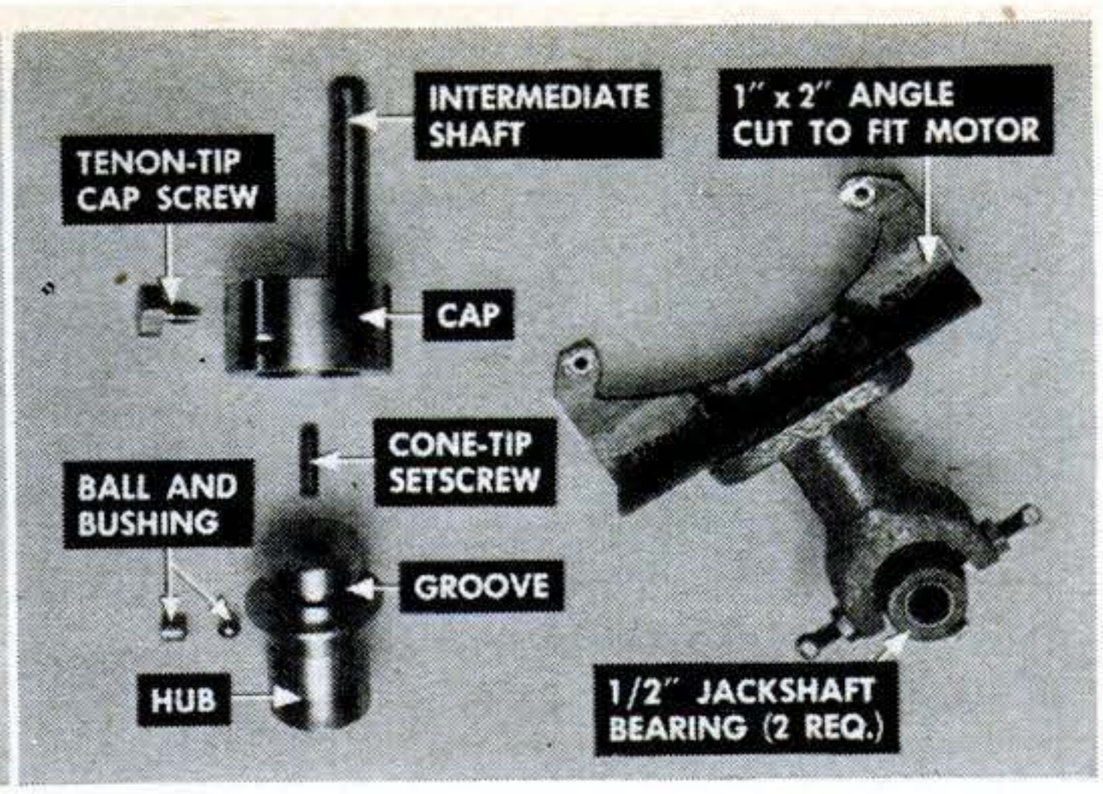




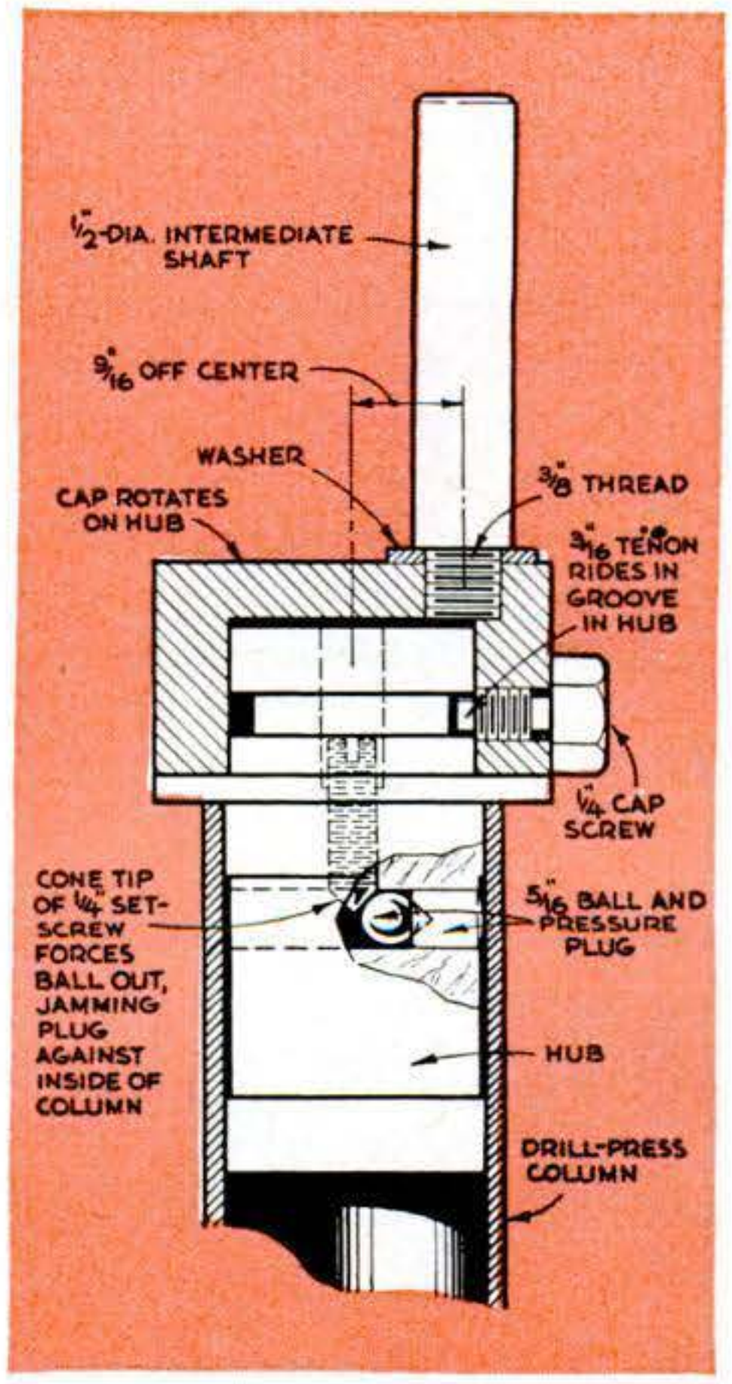
New Shop Ideas

Drill-Press Speed Changer. The experimenter, drilling one job at high speeds with Nos. 61 to 80 drills and the next with a slow-turning circle cutter, will find this wide-range speed changer an asset to the drill press.

Power is transmitted from a 2" pulley on the lower motor shaft to a 6" pulley on the jackshaft. A 4" four-step cone pulley atop the jackshaft is belted to a similar pulley on the intermediate shaft. This shaft "floats" on a swivel cap mounted on a hub turned to fit in the drill-press column (right above). This arrangement will give a speed range of 86 r.p.m. to 2,300 r.p.m. using a 1,725-r.p.m. motor. Vary the single pulleys for other speeds.

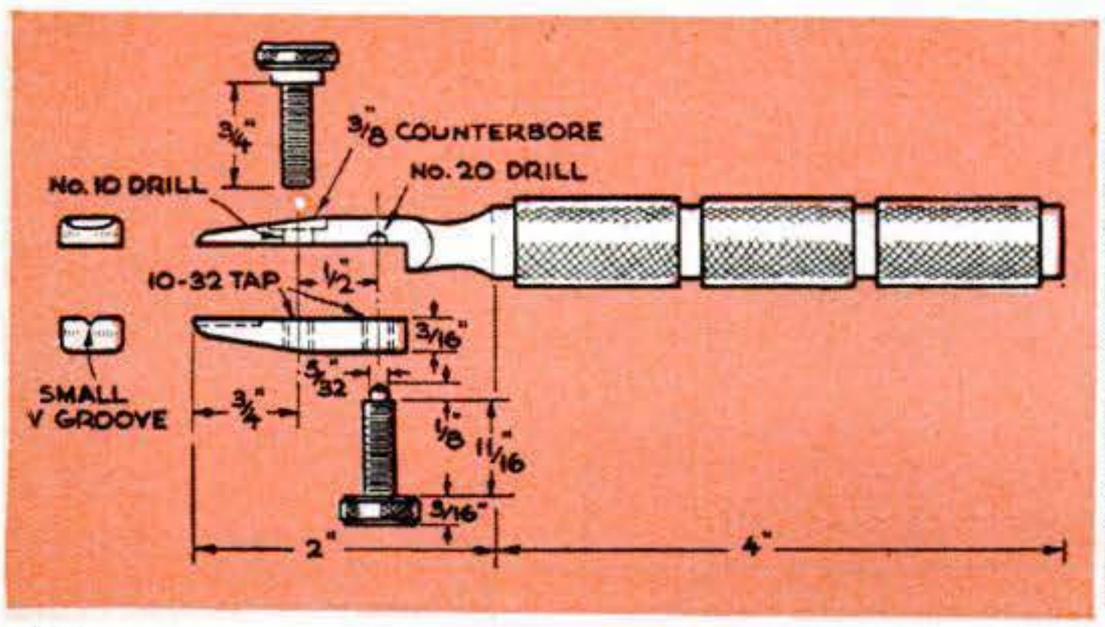
The hub and floating cap are turned from cold-rolled steel (right). The cap swivels freely and is held in place by a tenon-tipped cap screw which rides in a groove in the hub.

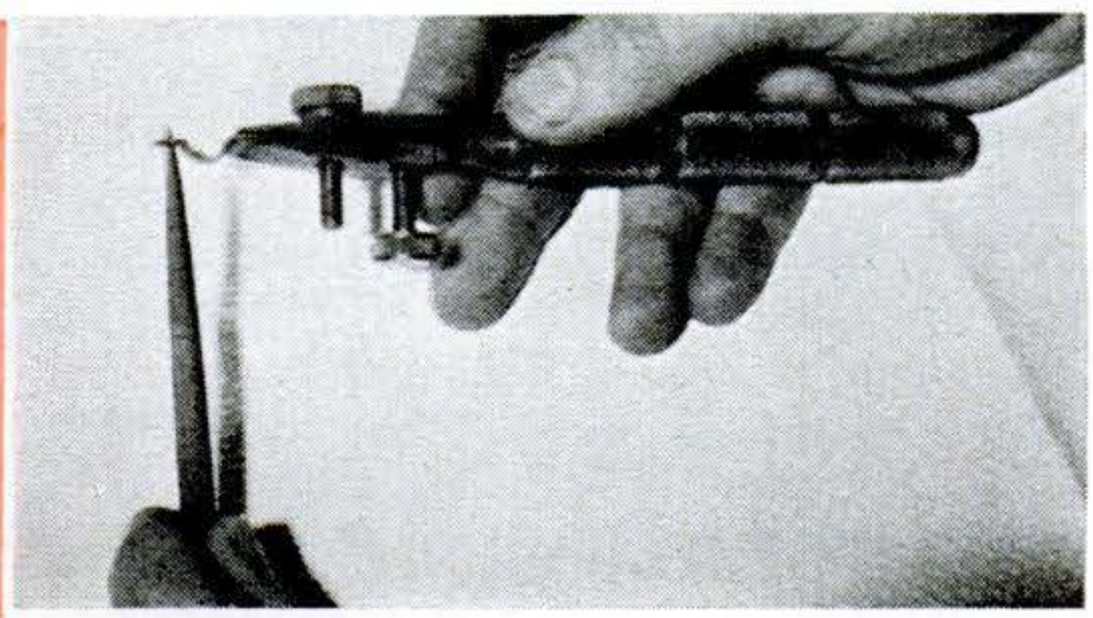
The jackshaft bearings are mounted on the motor with steel angles cut and drilled to fit. Replace two of the motor-housing bolts with longer threaded rods and lock nuts to fasten the angles in place.—*A. L. Sprecker, Freeport, N. Y.*



Pin Vise Has Parallel Jaws. Resembling a machinist's parallel clamp with a handle added, this pin vise is a useful addition to the modelmaker's toolbox.

Turn the handle and one jaw from a 6" length of 9/16" cold-rolled steel. Knurl the handle and drill it out to lighten it. File the jaw to shape and fit a matching jaw, cut from 3/16" flat stock, to it. Drill and counterbore the stationary jaw, and tap the adjustable jaw for the No. 10-32 thumbscrews, turned from 9/16" rod. Lock both jaws together with the thumbscrews and file them to a perfect match. File a narrow V groove in one jaw to grip pins or thin stock.—*R. H. Dalton, Roseville, Mich.*





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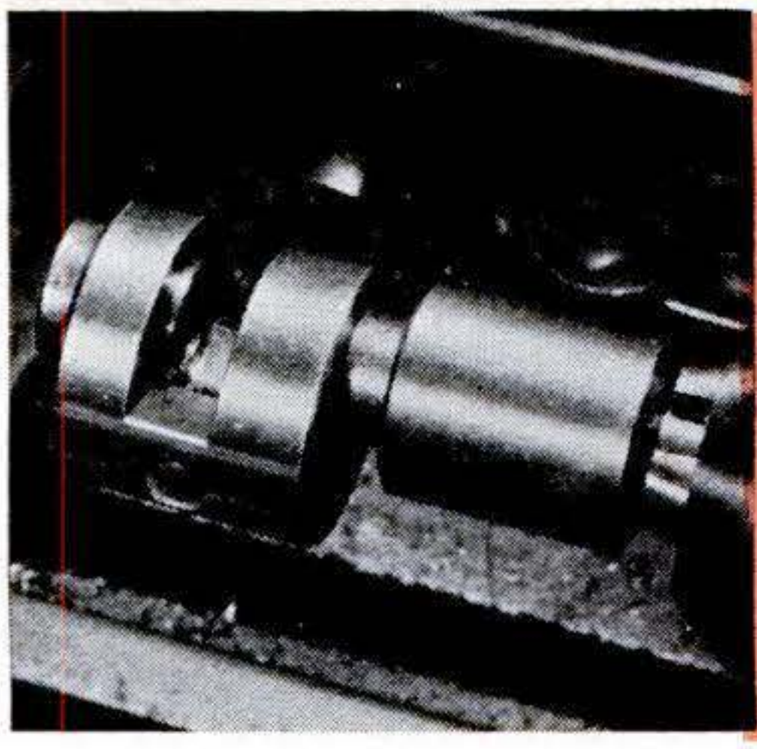
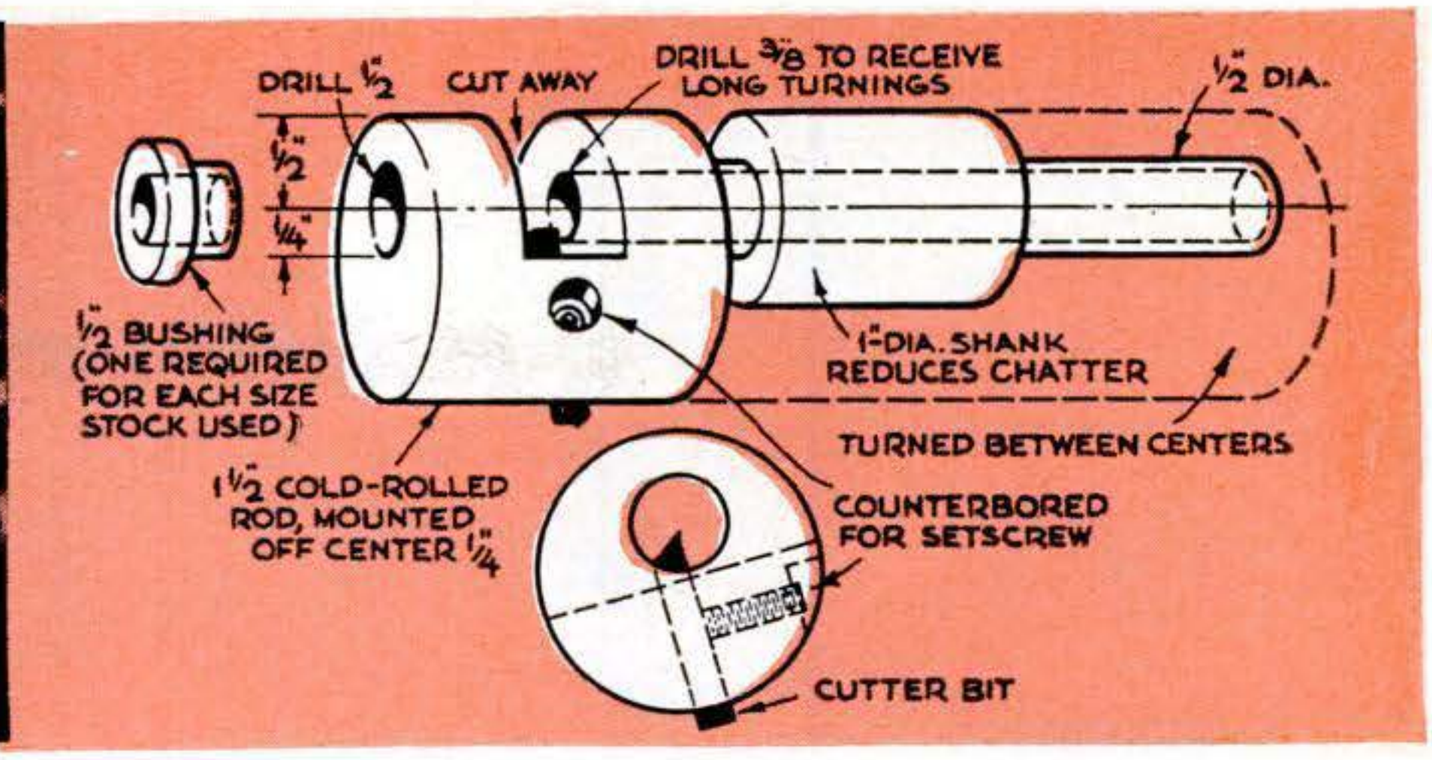


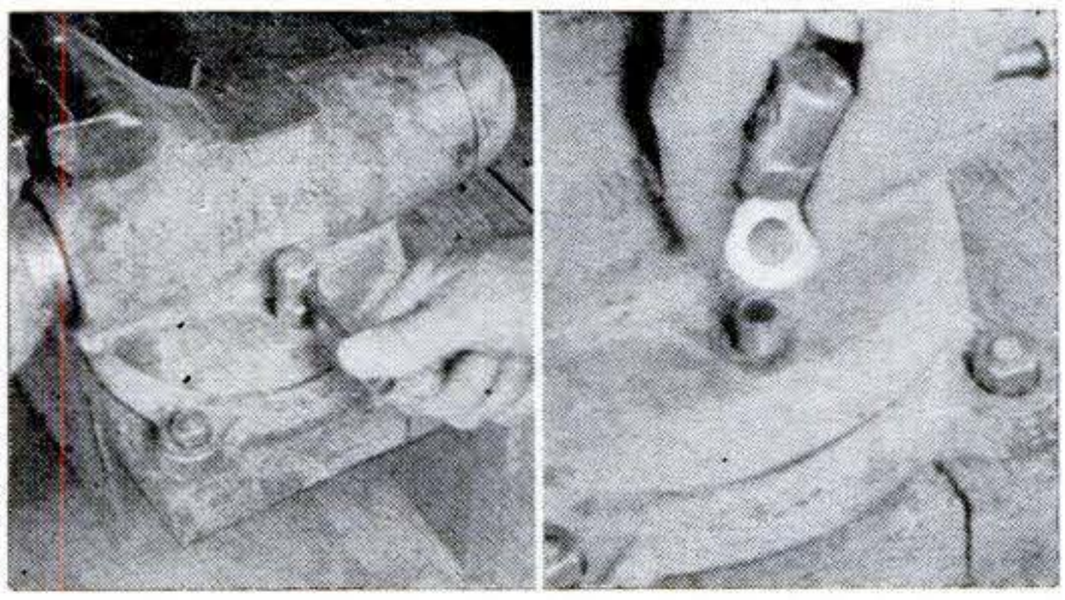


Hollow Mill Turns Screw Blanks. Especially useful when turning out a quantity of screws, this one-piece hollow end mill saves miking the shanks and frees the compound tool holder for cutting off.

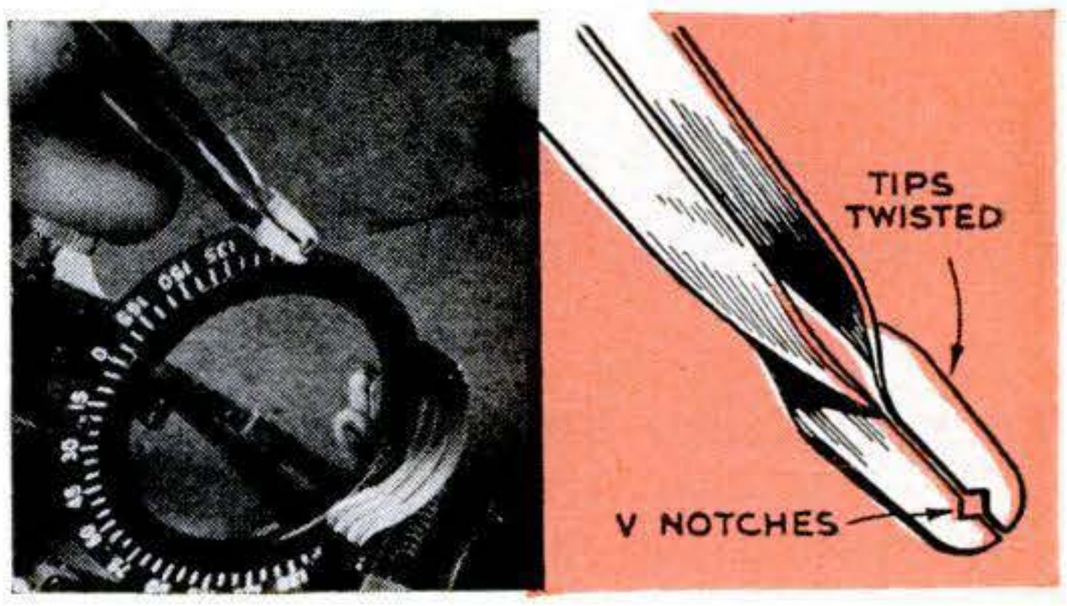
Turn it from a piece of 1½″ cold-rolled steel rod, about 4½″ long, mounted ¼″ off center. After forming the body, chuck the ½″ shank in the headstock chuck and drill a ½″ hole about ¾″ deep for the bushings. Follow with a ⅜″ drill completely through the body to give clearance for long turnings.

Mill or cut away a portion of the head as illustrated and drill a 5/16″ hole for the ¼″ cutter bit. Enlarge the hole by filing square corners to fit the cutter. Drill and tap for an Allen setscrew at 90° to the bit.

Turn a number of ½″ bushings and drill them as you need them for various sizes of rod stock.—*F. McGuckin, Ridgewood, N. J.*



Washer Adjusts Vise Lock. If the locking handle on your swivel-base vise projects over the end of the bench when tightened, try inserting steel washers of various thicknesses under the collar. Experiment until you find one that changes the thread position enough to make the handle lie close to the vise when tightened.—*Keith Heryford, Cedarville, Calif.*



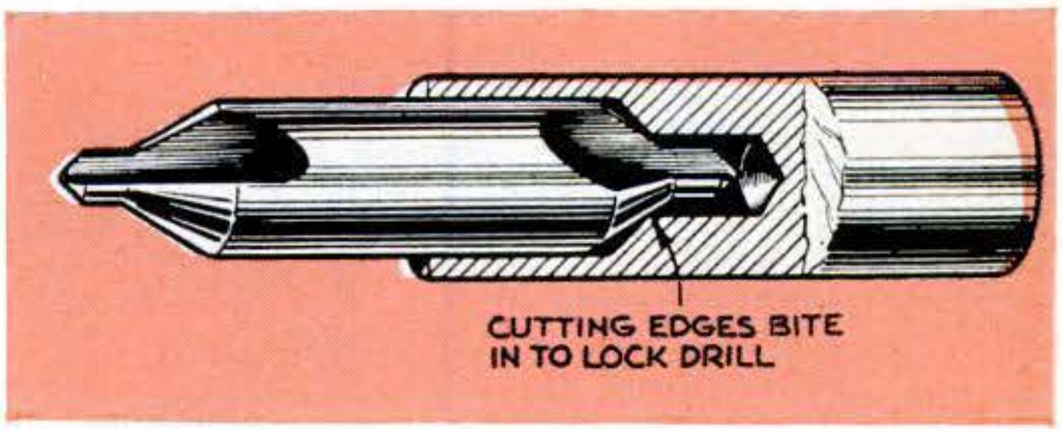
Tweezers Improved. An ordinary pair of tweezers can be altered to become an almost indispensable tool for delicate assembly work.

Anneal the tips by heating, and twist them so that the two edges butt together. File a small V in each tip to grip the thin shanks of tiny screws while starting them in their threads.

Quick Centerdrill Extension. Soldering drills to extension rods is an old dodge, but it takes time. Here is a simple way to extend a centerdrill, without soldering, to reach into out-of-the-way places.

Select a rod about ⅛″ larger than the diameter of the centerdrill body and drill a hole slightly larger than the centerdrill tip. Counterbore this hole to receive half the length of the drill body.

When the centerdrill is inserted and starts cutting, the flutes of the nonworking end will bite into the smaller hole, locking it against twisting. A counter twist to the left releases the drill for removal.—*L. E. Fannon, Huntington Park, Calif.*



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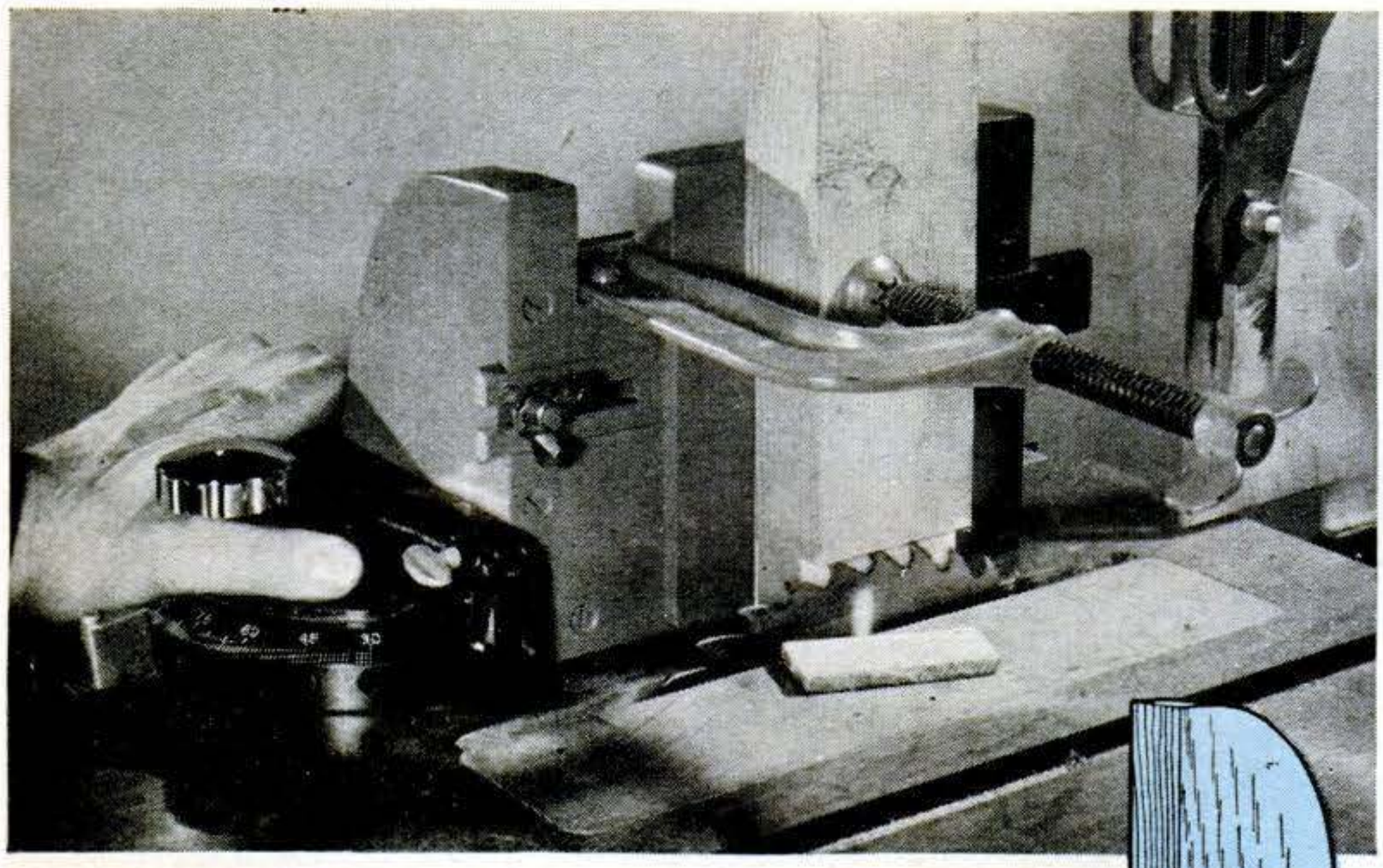
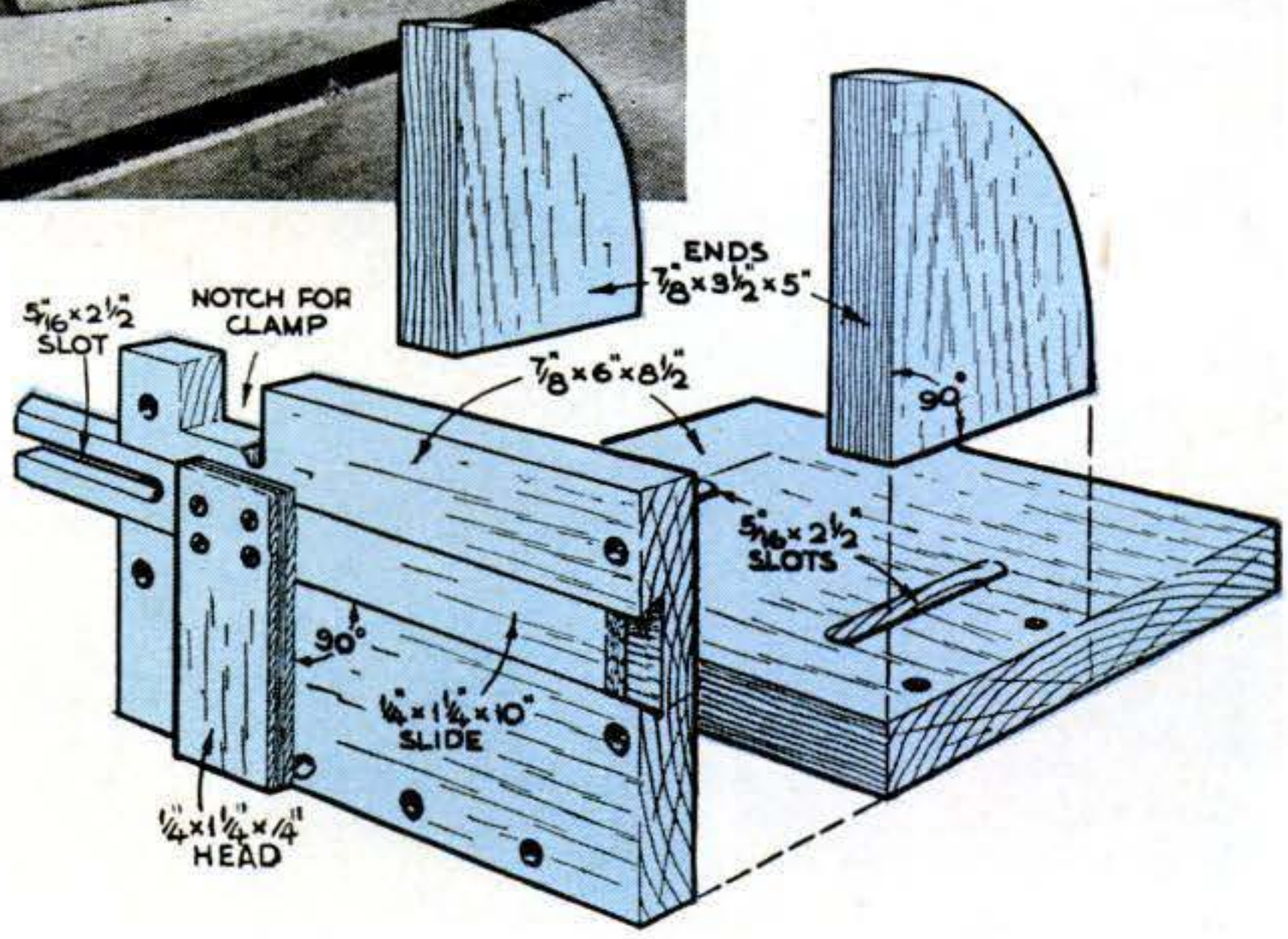


TRUE CUTS that make the cheeks parallel to the face are a matter of course with this jig. The work is clamped and can't teeter. Although guard must be swung out of the way, operation is safe because fingers come nowhere near the blade.

Homemade Jig Cuts Tenons Accurately

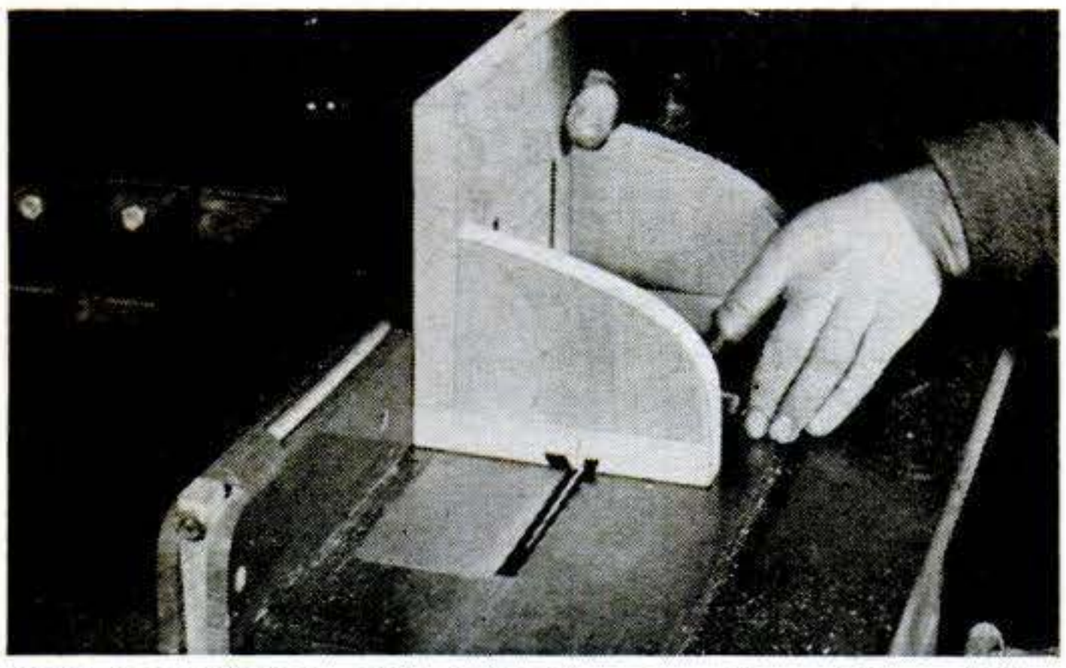


This circular-saw gadget puts a stop to juggling upended work.

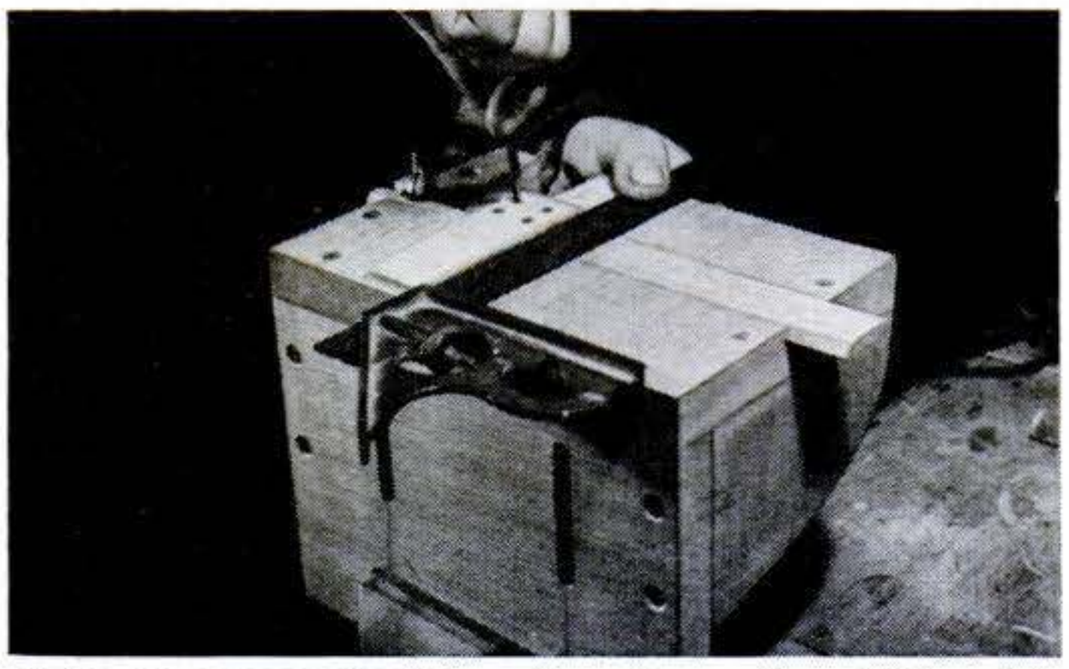
RIPPING tenons by holding stock upright against a circular-saw fence is touchy business. The thrust of the saw-teeth always tends to throw the naturally unstable work out of line.

But with this jig, cutting tenons or half laps on long pieces is a cinch. It will take stock up to 2½" thick. The adjustable slide permits centering any size of work directly under the foot of the clamp for a secure grip. Clamping is easy because the clamp itself is permanently attached.

With two blades spaced apart the thickness of the tenon, you can cut both the cheeks at one pass, a real advantage on duplicate work. By attaching a notched



CUT DOVETAIL GROOVE in the face like this. It should be slightly farther from base of jig than maximum height saw can project above table. Tilt saw or table 30° to rip each side. Remove waste with successive passes.



ATTACH CROSSPIECE, or head, to the slide with four wood screws, aligning it with square as above. Slide is notched at far end to pass clamping stud, which is a 5/16" bolt threaded into a ¼" hole in the face and cut short.

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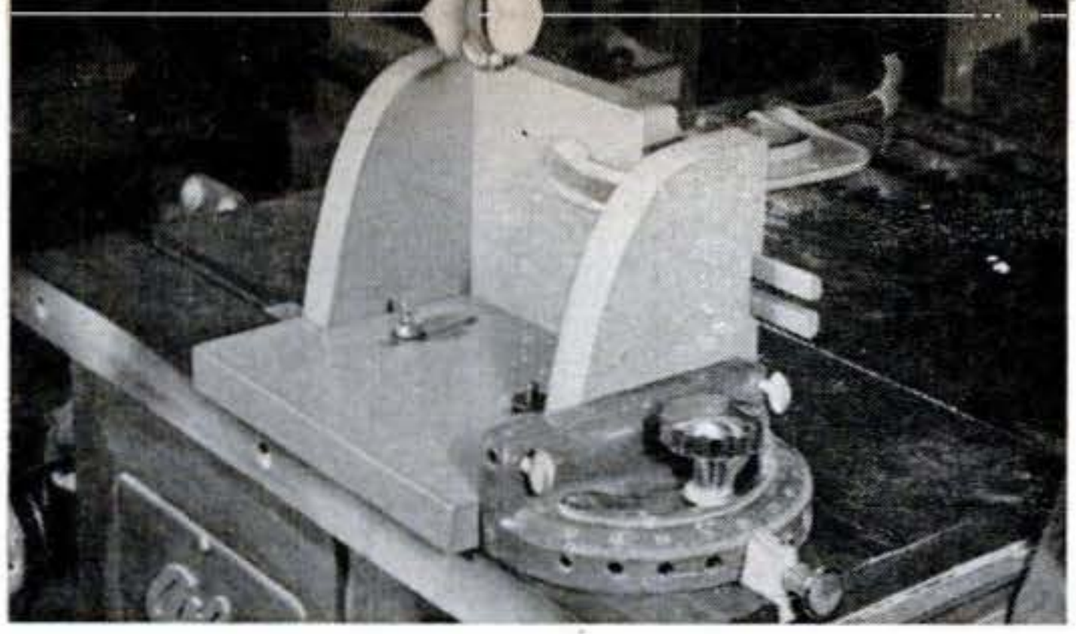
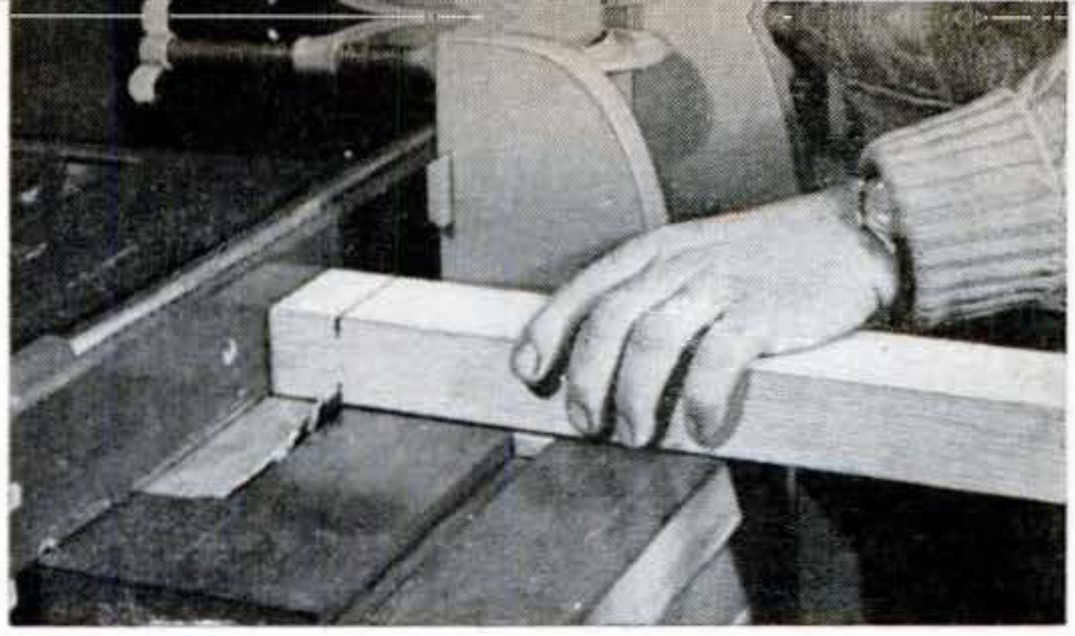


MOUNT THE JIG on the miter gauge with two 5/16" flathead bolts and wing nuts. The bolts go through the base slots and two holes drilled in the bar of the miter gauge. Butt jig firmly against the head of the gauge.



CUT TENON SHOULDERS FIRST, holding work against front end of jig as above. Use fence as stop gauge. Flip over to cut second shoulder. Then clamp stock upright in jig, as in top photo on facing page, to rip cheeks.

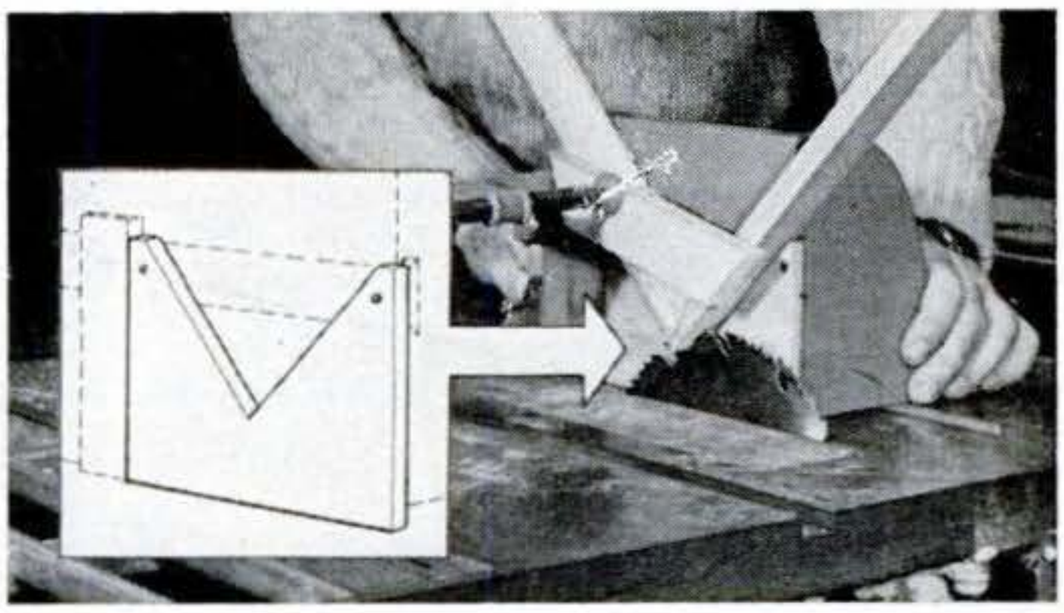
piece of plywood to the slide, you can hold mitered members to groove the joint for a spline.

Check the dimensions against the size of your own saw. The jig shown is for an 8" machine. Cut the main parts from ⅞" maple, oak or birch. Lay out the base slots so that, with bolts through them into the miter-gauge bar, the face of the jig can be adjusted from within ¼" to 2½" of the saw blade. Jigsaw the slots.

Drill two 5/16" holes in the bar to suit the slot spacing. Countersink them from beneath for flathead bolts.

Assemble the base, face piece and two ends of the jig with glue and deeply countersunk wood screws. Be sure the ends are precisely square with the face.

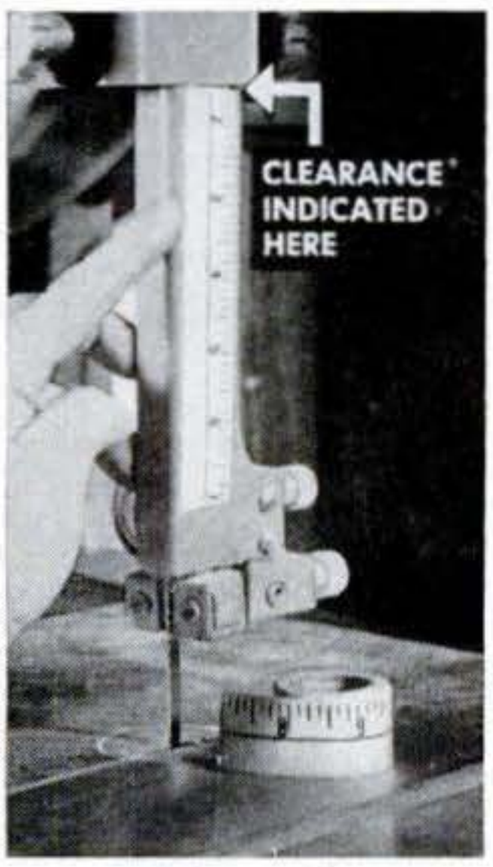
Rip the ¼"deep dovetail groove just above maximum saw height, so that the blade can't hit the slide clamping nut. Notch the face above the slide for a 4" C clamp. Then cut the slide to fit the groove and attach the head, as shown in the photos.



SPLINE GROOVES in mitered joints are made with parts clamped in a 90° notch cut in a piece of ¼" plywood. This is attached to the dovetail slide with two screws. Block under clamp secures both parts of work.

Secure the clamp with a wood screw run into the bottom of the notch. Finish the jig with shellac, lacquer or enamel.—*Herbert Pfister, The Bronx, N. Y.*

Tape Shows Bandsaw Clearance



It's awkward to get a heavy, overhanging piece of work up on the bandsaw table and then find it won't go under the blade guide. A piece of measuring tape fastened to the sliding guard, as at left, will show against some stationary point (the bottom of the wheel guard in this case) actual clearance above the table. Thus it can be set beforehand.

The tape shown is self-adhering, but sewing tape can be cemented on, or steel tape riveted in place.

Shoptalk:

What are they talking about? Where do they work? Answer below.

They're mechanics at an Air Force Base. Sky scanner is slang for radar. A boogie is an unidentified aircraft and a gooney bird is a C-47 transport plane.

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How to Choose Plugs for Household Appliances

The right ones will last longer and prevent fires, shocks and shorts.

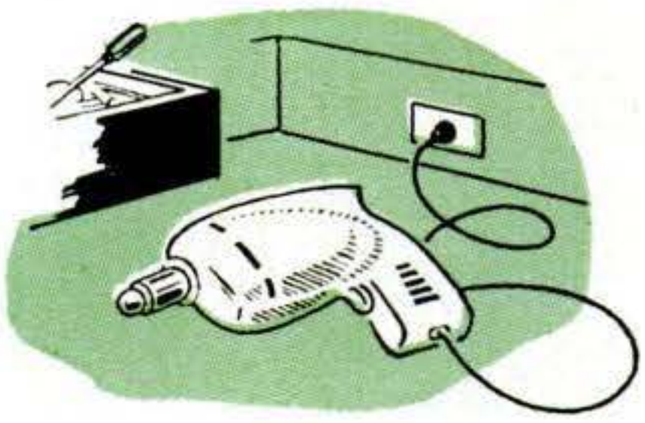
IF YOU are a plug snatcher—borrowing one from a lamp to put a toaster back in business—you are shortchanging your appliances. Electric plugs aren't all alike.

Though many plugs will work interchangeably, there is a preferred type for every job. Some are made to stand frequent plugging and unplugging, some to carry heavy current, some to bounce back when they are dropped or stepped on. There are plugs that lock into sockets and others that fit only one way so the "hot" and grounded sides of the AC line can't get crossed.

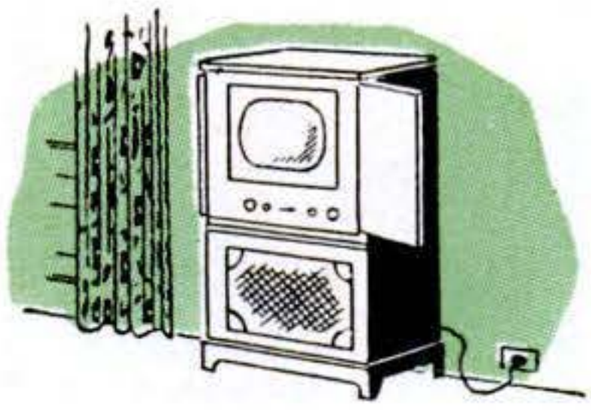
Next time you replace a fixture plug, use the right one the right way. Always leave a margin of safety by wiring appliances to take abuse—then not abusing them.—*Carlton Strickland, Roanoke, Va.*

TYPES OF PLUGS

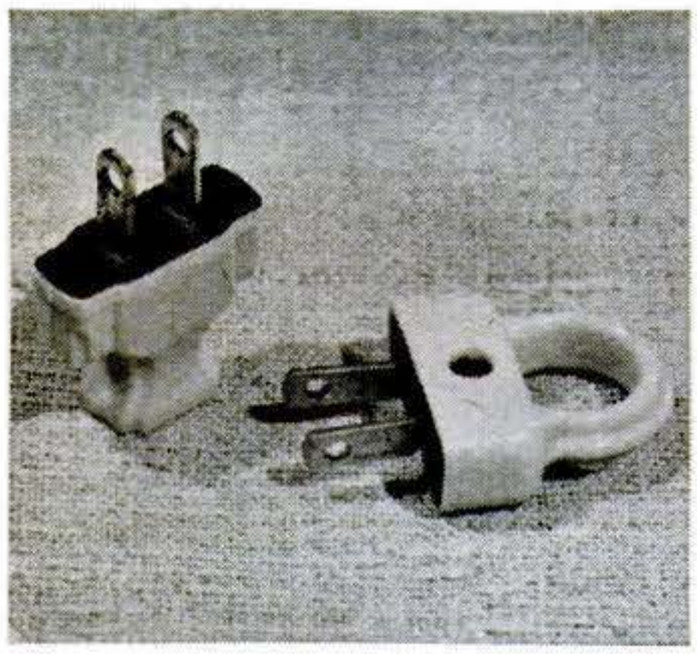
GRIP PLUGS having shanks or finger loops are first choice for light-duty appliances that must be plugged and unplugged frequently.

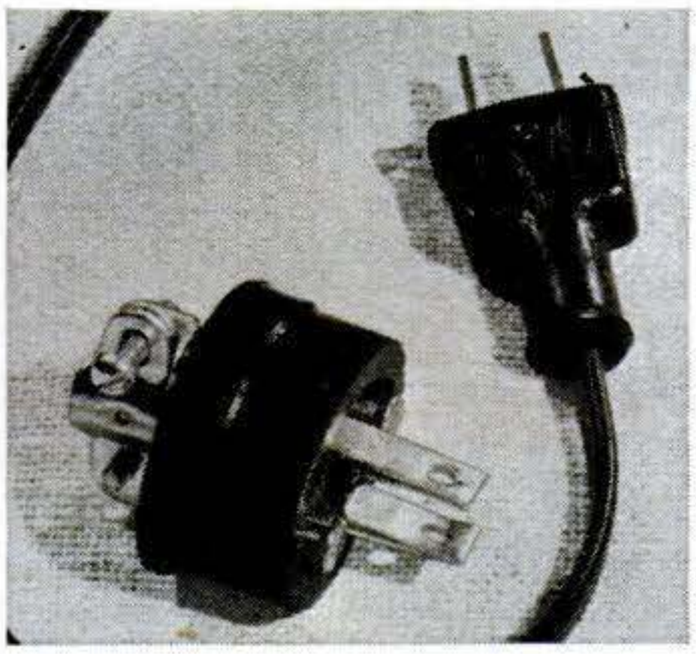


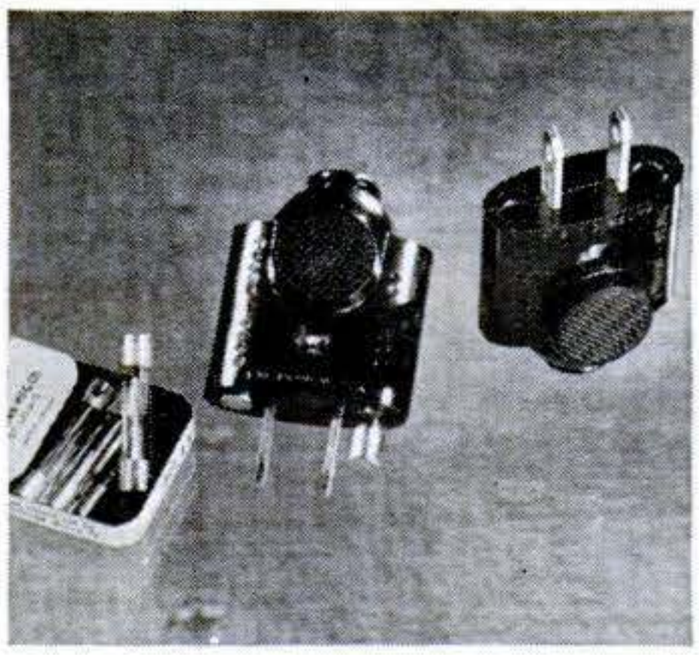
RUBBER PLUGS take heavy handling in their stride, should be used in shop, kitchen. Clamp (left below) makes sure wire won't pull loose.



FUSED PLUGS with low-amperage auto-type fuses give appliances extra protection, let house lights stay on if trouble develops.





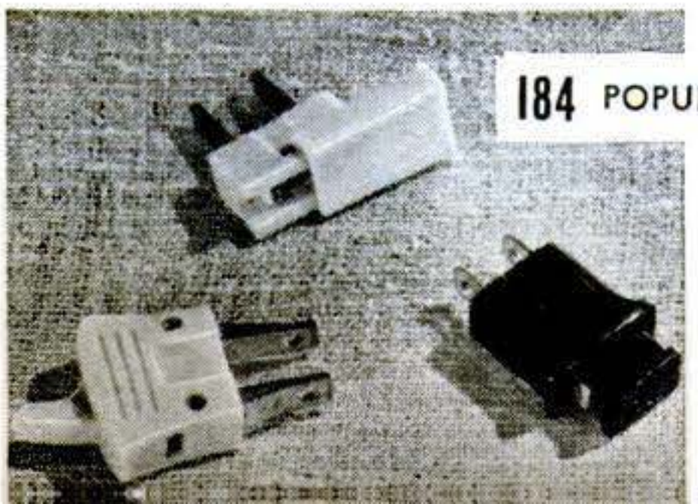


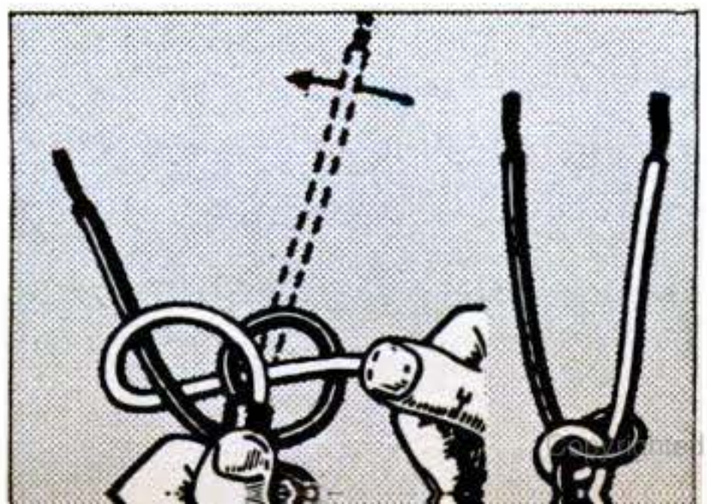
HOW TO WIRE A PLUG

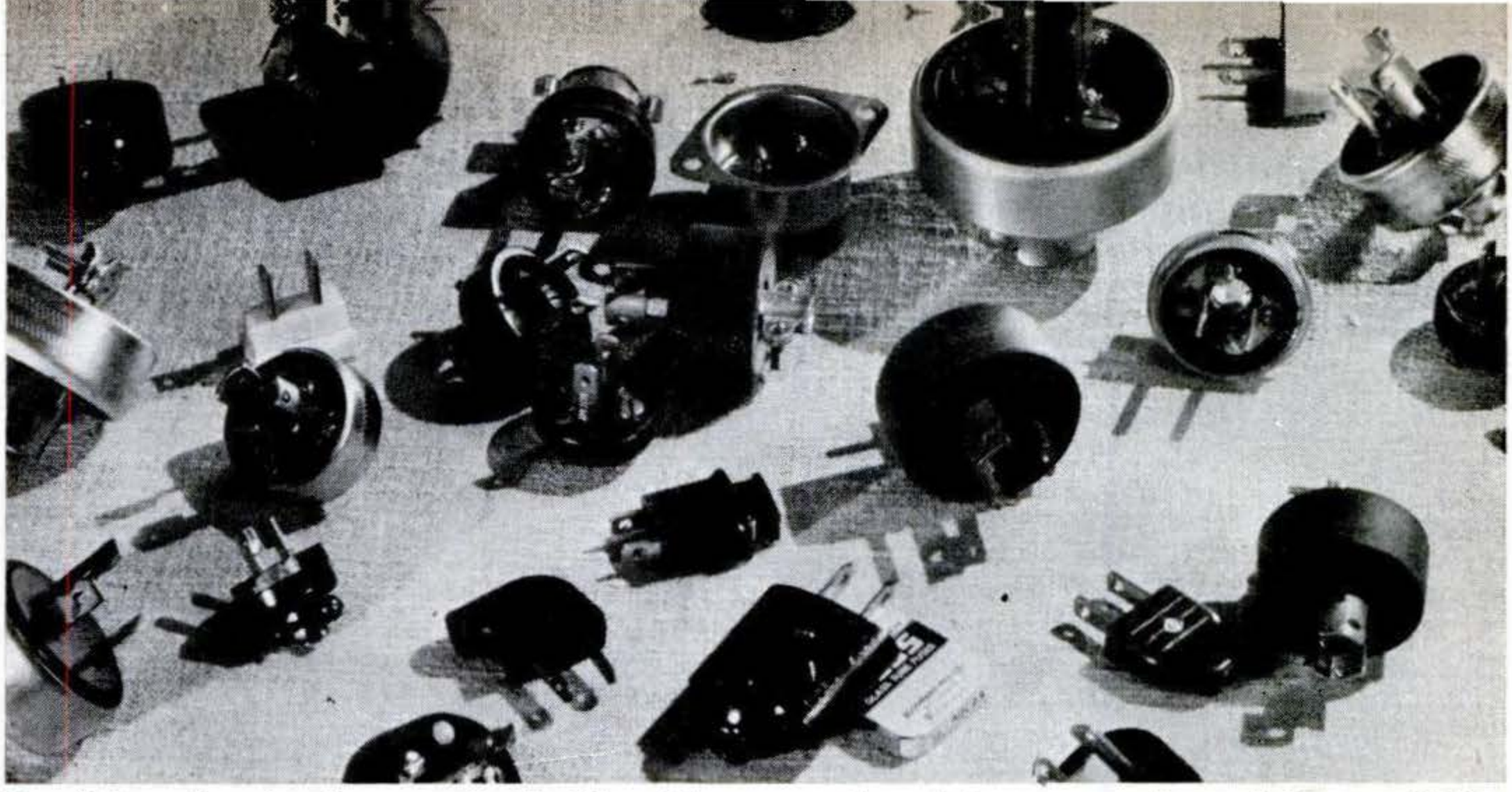
NEW PLUGS connect themselves to flat, two-conductor wire. You just insert wire in hole or slot and slide plug sections together—no tools, no wire stripping. This type is meant for light duty only.

WITH SCREW-CONNECTED PLUGS, you must first bare tip of wire and twist strands so they stay together. Loop each lead *around* prong and hook wire tip *clockwise* so screw won't back wire out.

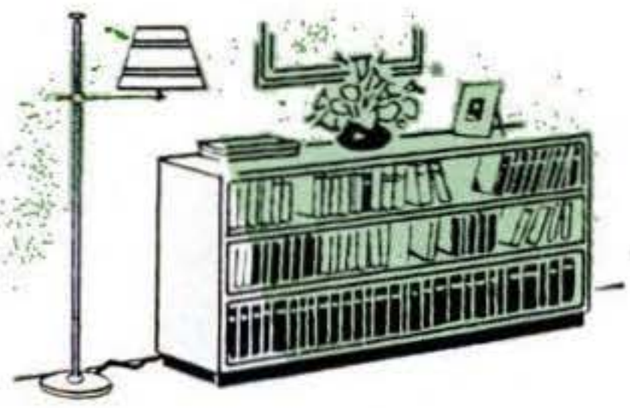
UNDERWRITERS' KNOT relieves pull on wire. Tied this way, knot wedges in plug neck, keeps pull from loosening connections. Ordinary knot may tighten unevenly, let contacts pull loose.





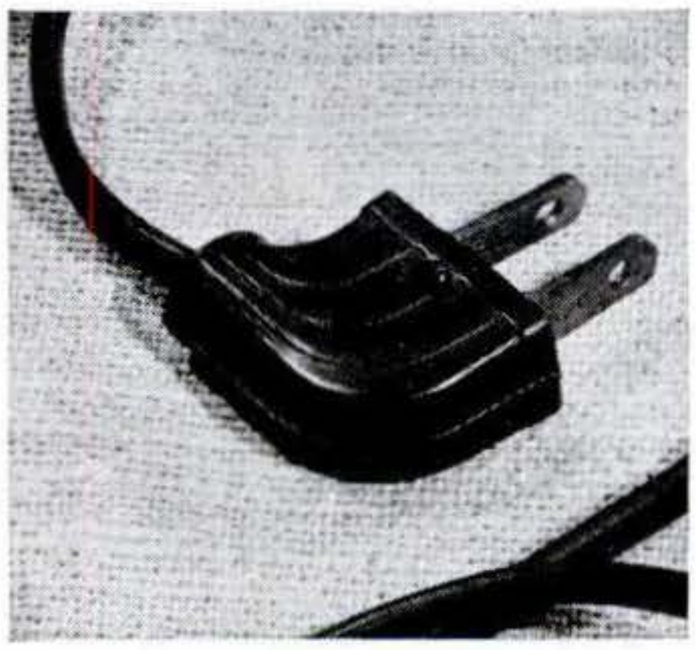


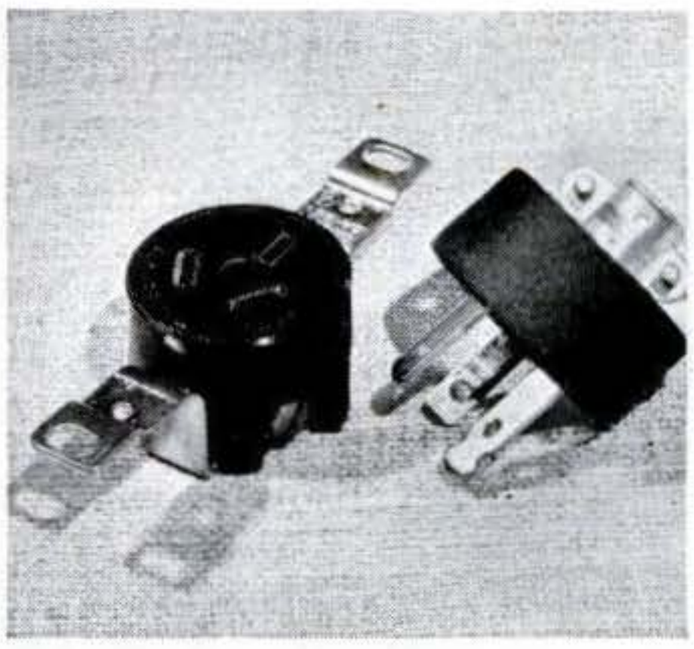
Proof that electric plugs aren't all alike. Here are a few of the many styles and sizes available.

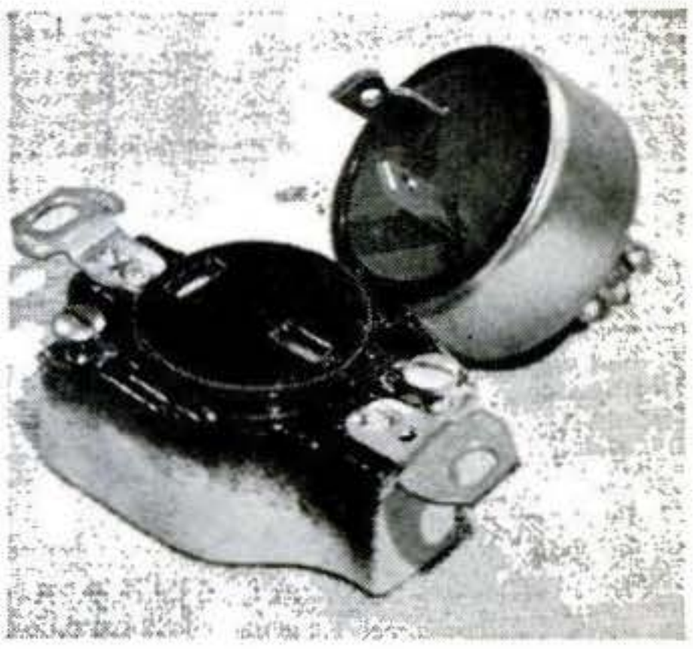


SIDE-ENTRY PLUG fits narrow space behind chest or bookcase. It saves floor space, and abrasion from furniture can't fray or damage wire.

POLARIZED PLUGS, which fit their special sockets only one way, are a safety requirement for equipment like power tools and washing machines. Properly installed, one prong grounds machine frame. This prevents shocks—especially dangerous in cellars—if a short should make frame "hot."





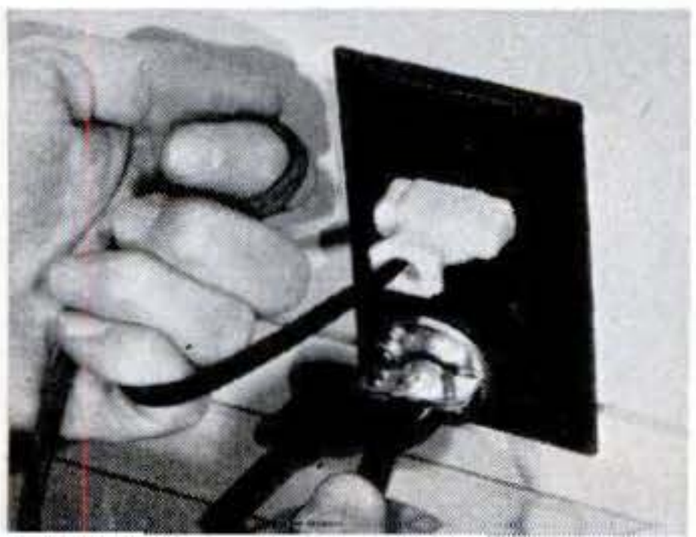


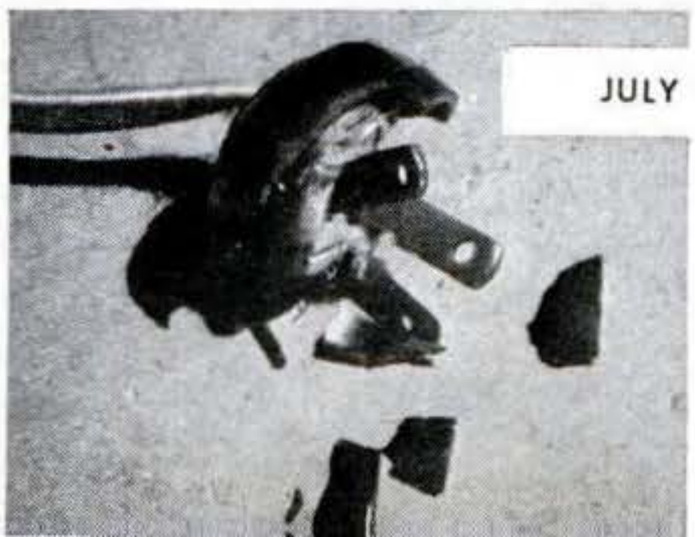
PLUG DON'TS

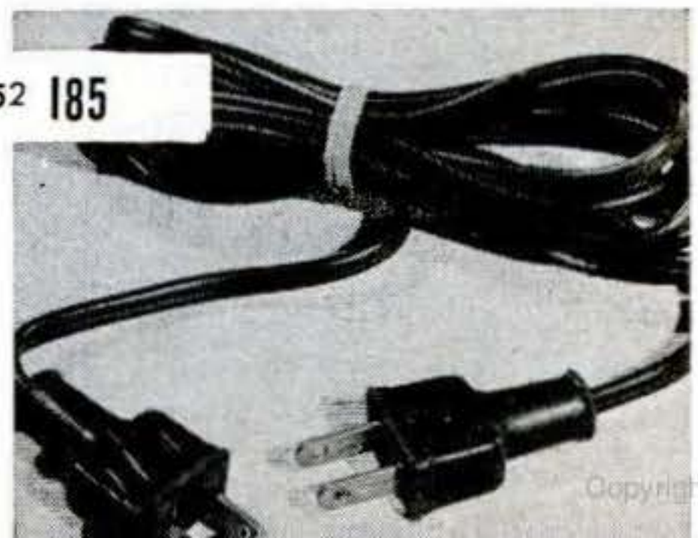
DON'T YANK THE WIRE. You'll probably have to keep after the wife and kiddies to eliminate this cause of broken wires and loose connections, which can be a nuisance, lead to shorts, shocks and fires.

DON'T USE BRITTLE PLUGS where they may be dropped or stepped on. Rubber plugs stand more abuse, are better for shop and kitchen appliances. Heavy plugs are okay for light appliances.

DON'T DOUBLE-END A WIRE. One of these plugs would be dangerous if the other were inserted in a socket. When making extensions, pair plugs and sockets only. Free plugs should never be hot.







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New Garden Tools

Cam-Operated Lawn Trimmer Cuts as You Push It Along

TRIMMING along the edges of a lawn is easy with this tool. As you push it along, cams on the wheels actuate a cam follower on each side. The followers in turn oscillate the upper cutter blade of the miniature sickle bar. The bottom view of the Bolens Trim-Master (right above) shows the cams and one of the followers. The aluminum wheel has a rubber tread. *Food Machinery and Chemical Corp., Port Washington, Wis.*

Sprinkler Looks Like Flower

CIRCLES up to 40′ in diameter can be sprayed with this plastic lawn sprinkler that looks like a blossom in a flowerpot. Water pressure revolves the tube and flower. A rustproof metal spike is jammed in the ground to hold the sprinkler upright. *Emenee Industries, Inc., 200 Fifth Ave., New York City.*

Tools Fit in Garden Basket

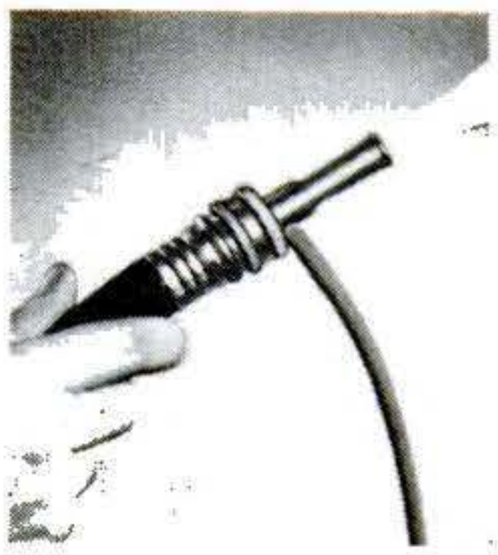
SIX garden tools, a rubber kneeling pad and gloves can be carried in this fitted garden basket. The tools are a dibbler, knife, trowel, fork, transplanter and shears. *Hammacher Schlemmer, 145 E. 57th St., New York City.*

Pruning Tool Picks Flowers

THIS 18″ aluminum pruning tool reaches high places or through branches to snip off a flower and hold it by the stem while you retrieve it. Squeezing a lever on the handle operates the blade, which can be removed for sharpening. *J. Wiss & Sons, Newark, N.J.*

Hose Nozzle Mixes Plant Spray

THE venturi action of this nozzle sucks liquids—weed killer, fertilizer, insecticide—from a bucket and mixes them with water from a garden hose. Liquid is drawn from the bucket through a 5′ suction hose. Detergent also can be sucked up and the spray-mix nozzle used to wash cars, windows or siding. *Melnor Metal Products Co., 112 Lafayette St., New York City.*



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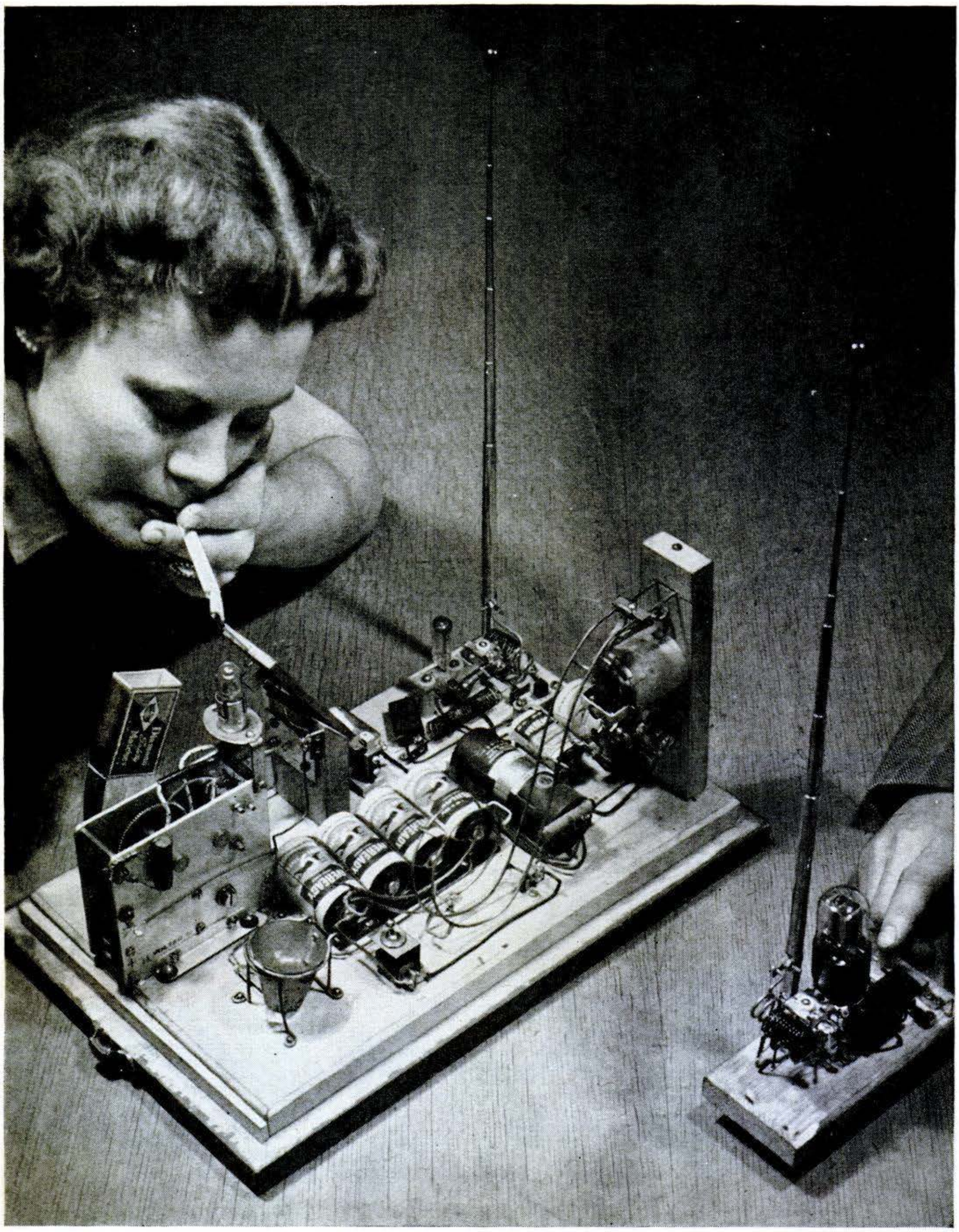

With This Machinery You Strike a Match

AN ELECTRONICS engineer with a Rube Goldberg sense of humor designed this radio-controlled cigarette lighter.

The control transmitter is the one-tube unit at right. When the receiver picks up a signal pulse, a ball bearing is released from the upright wood block, rolls down the wire track, performs a neat loop and drops into the funnel. This turns on a switch that starts a spring-wound motor, and the motor trips a mousetrap that has a match on one end. The match strikes against the matchbox and you're ready to light up. The match is not blown out by radio.

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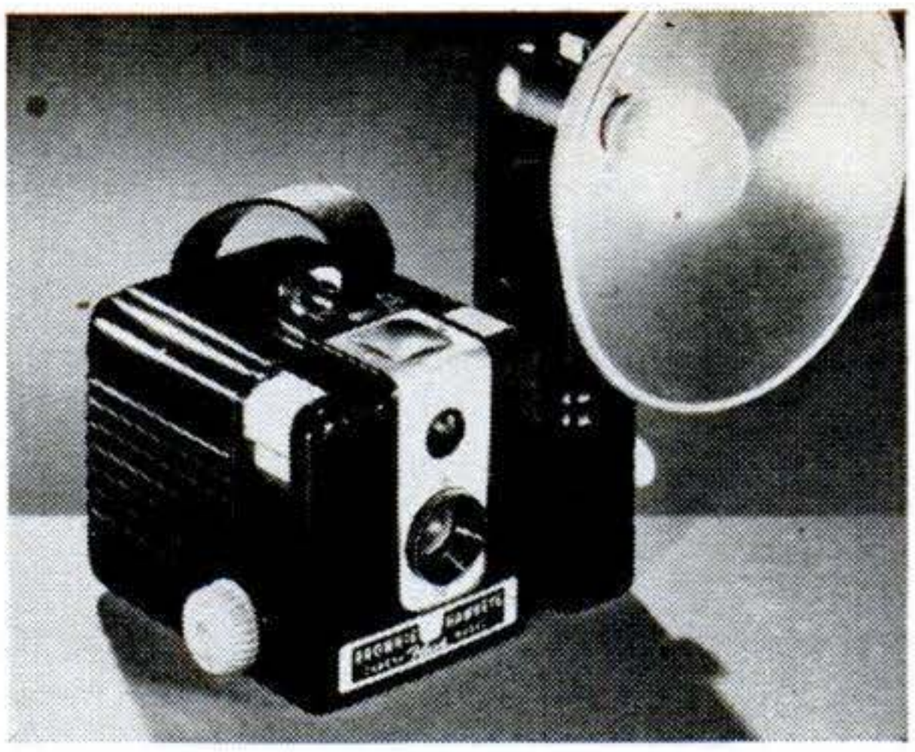
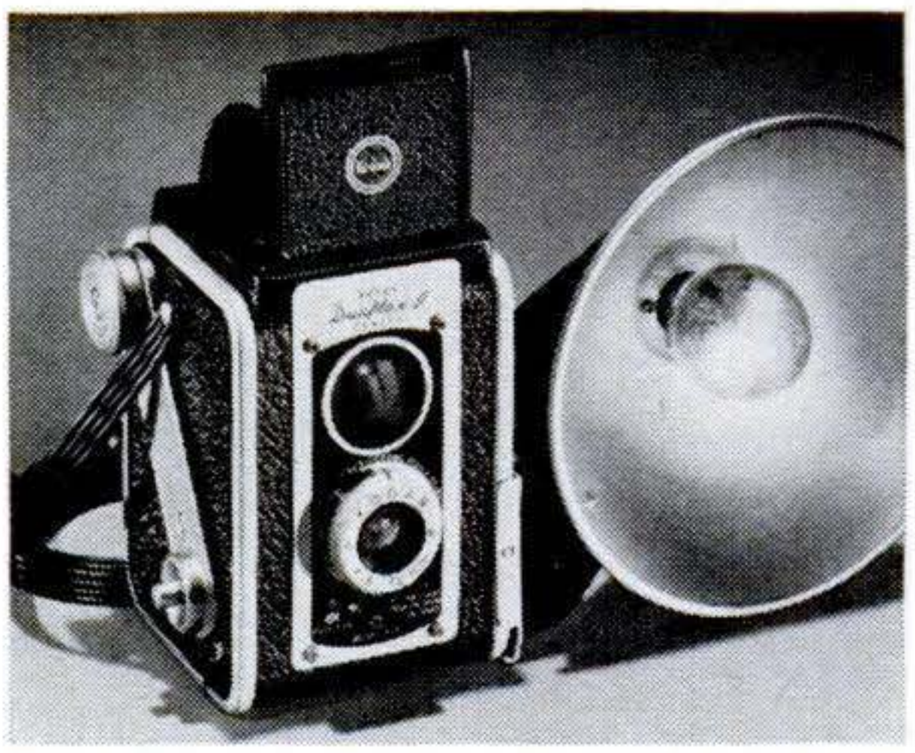
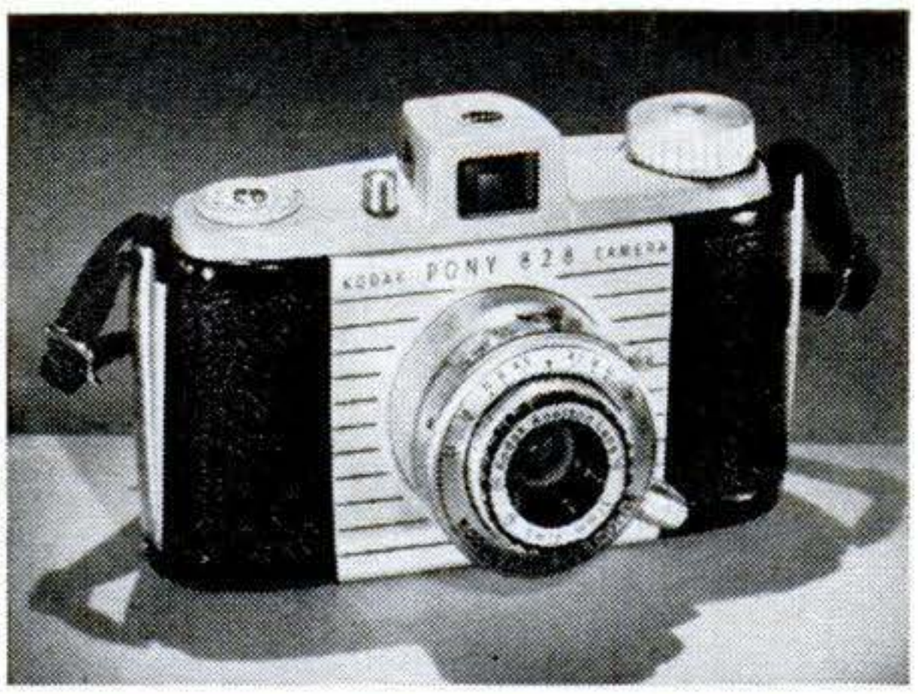


For night and day shots—The Brownie Hawkeye Camera, Flash Model, has fixed-focus lens . . . just aim and shoot. New smooth-action shutter release with built-in flash gives steady exposures. 2 ¼ x 2 ¼ negative size. Takes brilliant Kodacolor shots, too. Camera, $7.20; Flasholder, $3.39.

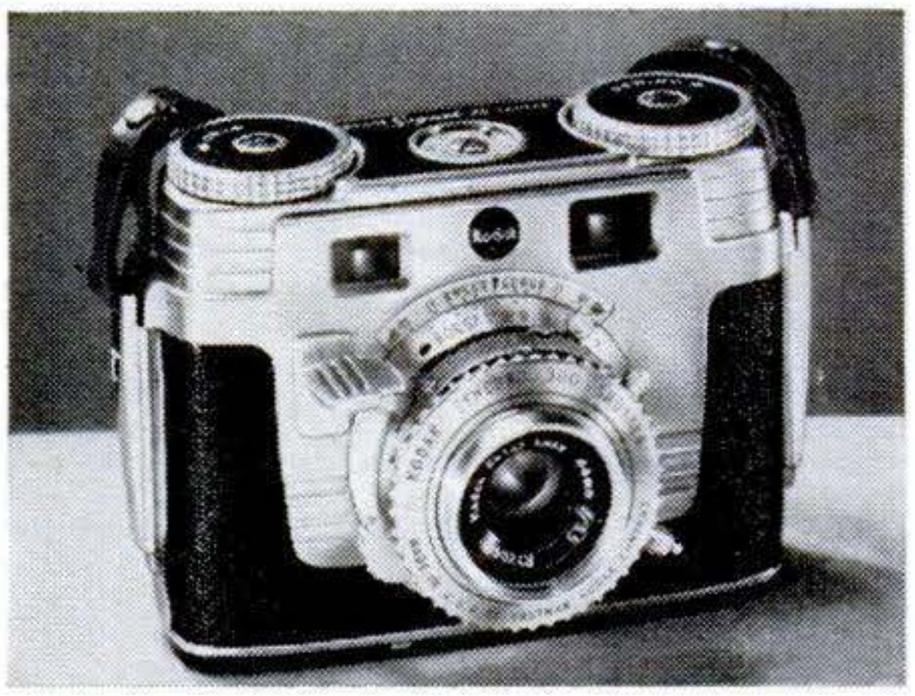


Hooded, view finder in the Kodak Duaflex II Camera previews the picture, big and clear. Two models for black-and-white and color shots: Kodet (shown) is fixed-focus, $14.50; Kodar has *f*/8 lens, double-exposure prevention, exposure guide, $22.30. Kodak Duaflex Flasholder, $3.00.

The Latest . . .



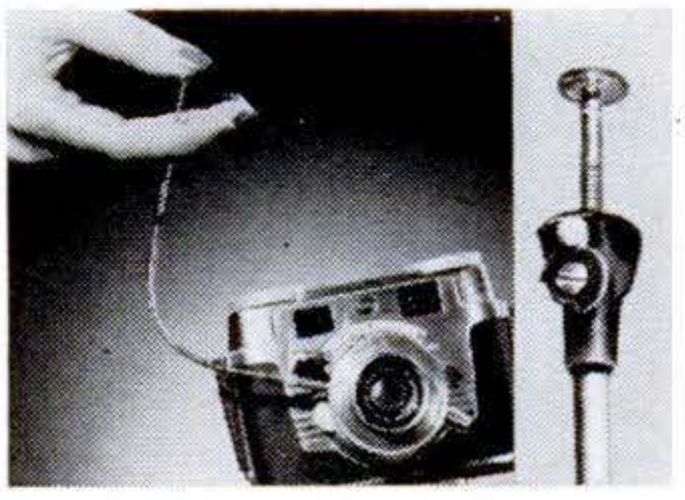
Thrifty color miniature—The Kodak Pony 828 Camera makes superb color slides on Kodachrome Film; sharp black-and-whites; beautiful full-color snapshots from Kodacolor Film. Fine *f*/4.5 lens in 1/200 flash shutter. Average settings marked in red for box-camera simplicity when desired. $31.15.



Kodak's new range-finder "miniature" with famous Ektar Lens (*f*/3.5)—the Kodak Signet 35 Camera. Unsurpassed for making brilliant 35mm. color slides. Key features include new-design range finder; 1/300 flash shutter; double-exposure prevention; automatic film stop and counter. $92.50.

Protect your camera with a Kodak carrying case like this handsome leather field case for the "Pony 828." Only $7.00. Other cases from $4.25 to $11.25 (simulated leather case for Duaflex Cameras, $2.65).

Get into that vacation picture with a Kodak Auto-Release (for any camera equipped with cable release). Set it . . . you have 10 seconds to join the group before the shutter clicks. $3.86.



The professional touch is yours with Kodak Metal Cable Release, No. 5 (left), $1.05, $1.30; or T.B.I. Metal Cable Release, No. 2 (right), $3.43. Sure way to prevent jarring of camera.

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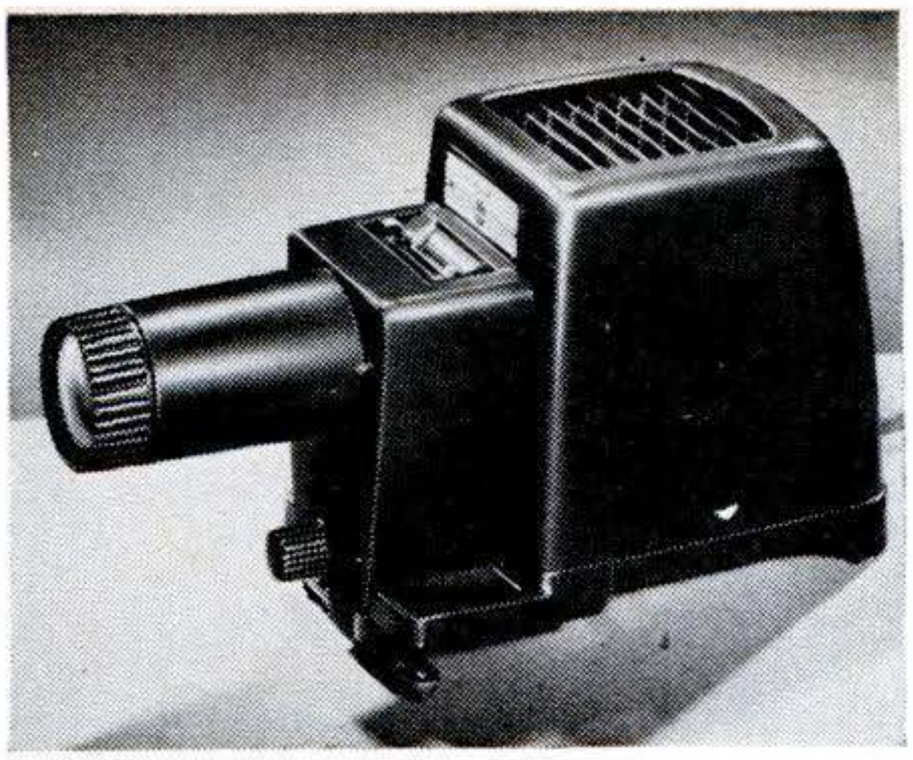
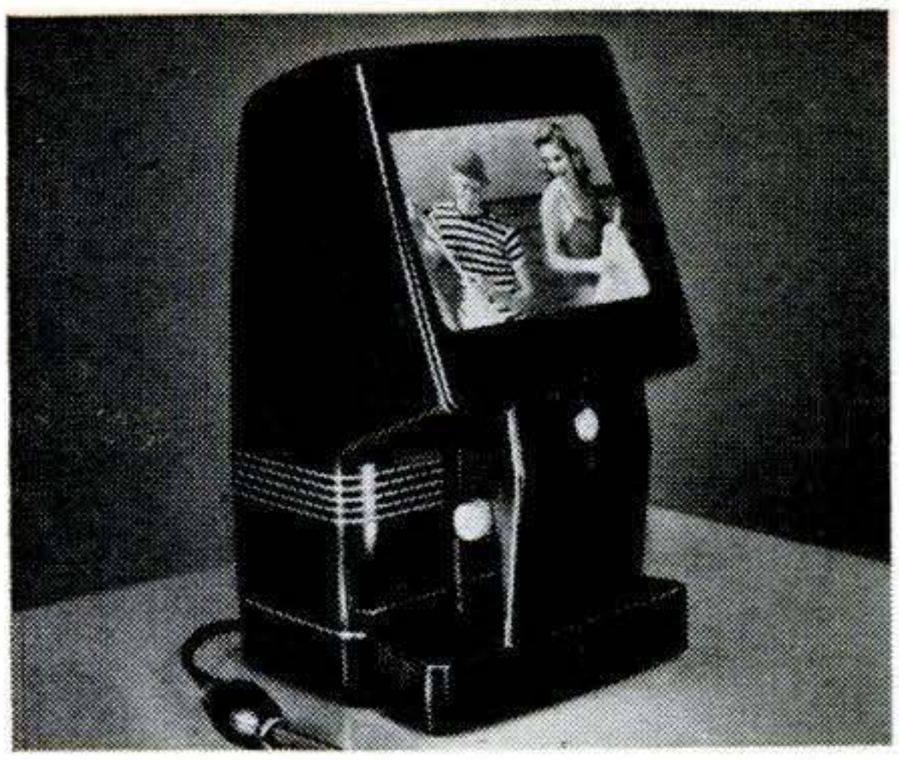
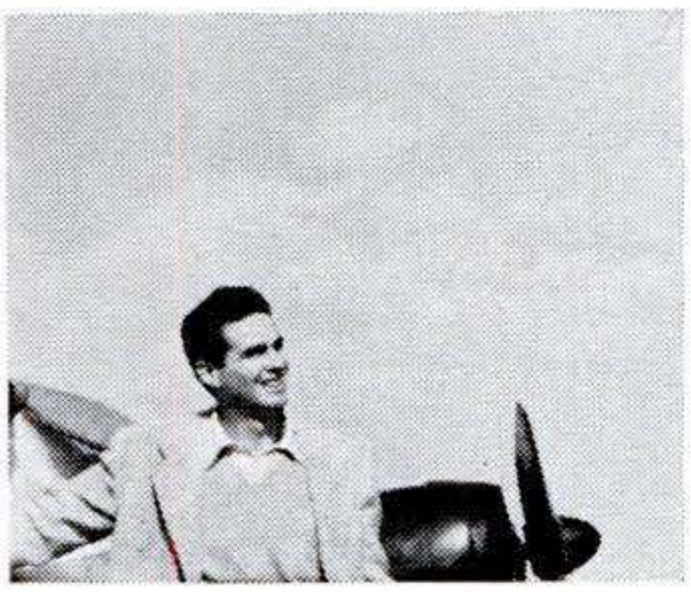


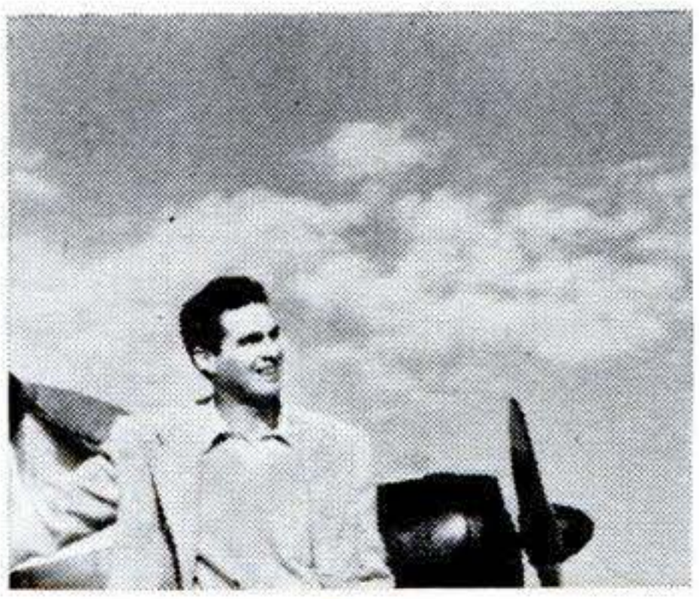
Show off your 2 x 2 slides with the Kodaslide Merit Projector. New easy-feed slide mechanism in *top* of projector means smooth, jar-free showings. Powerful 150-watt lamp and Kodak Projection Ektanon Lumenized Lens, 5-inch, *f*/3.5, give brilliant images on your home screen. $26.10.

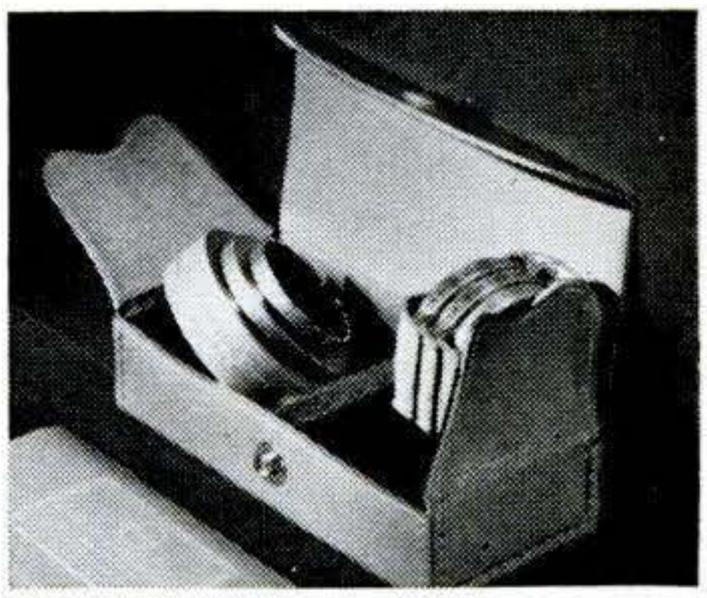


For convenient showings in daylight or lighted rooms—Kodaslide Table Viewer, 4X, combines screen and projector in one handy unit. Plug in and you're set. You'll see your vacation slides beautifully enlarged more than 4 times—bright and clear even in a fully lighted room. $49.50.

in inexpensive photo equipment for vacation fun







Filters can do wonders for your vacation shots—The illustrations above show how the yellow Kodak Wratten Filter K2 makes clouds natural-looking. Your Kodak dealer will gladly tell you about filters . . . how you can make spectacular photos of the sky with the red A Filter; about the green X1 Filter for giving faces a natural modeling against blue sky; all about many other types of lens attachments, including Lens Hood for protecting lens from direct sunlight, Pola-Screen for darkening the sky in color pictures, Portra Lenses for close-ups. Prices of filters start at $1.65.

Easy way to protect your filters is provided by the Kodak Combination Filter Case. Handsome leather, with reinforced compartments. Fits neatly in your pocket. One compartment holds Kodak Adapter Ring, Filter, Lens Hood; the second holds three filters. Series V, $4.25; Series VI, $4.95.

Store up to 240 cardboard slides in the deluxe Kodaslide Compartment File—or 96 glass slides. Has 12 handy swing-out compartments. Index inside cover. $3.94.

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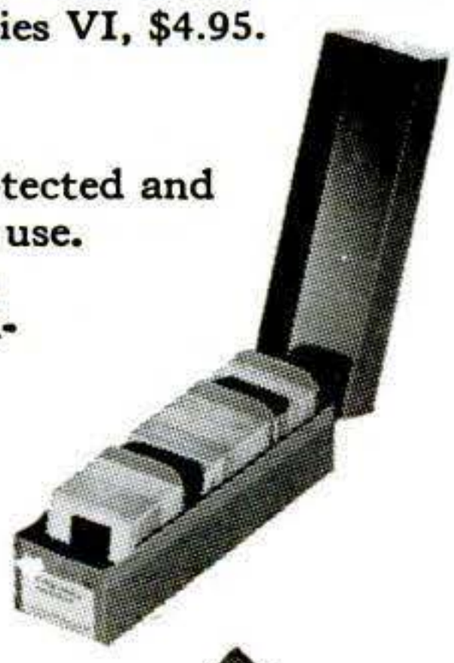

Your Kodak dealer is prepared to give you valuable help in the selection of photographic needs for your vacation. Why not take advantage of his training and experience today? He'll be pleased to see you at any time.

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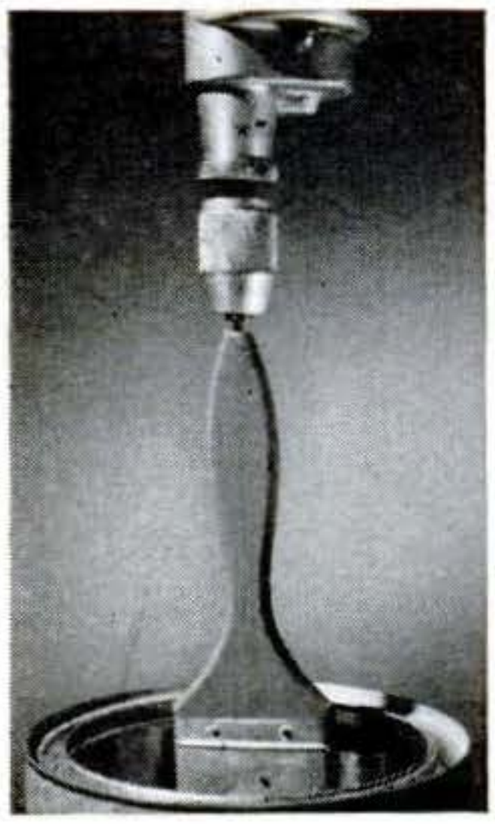
TRADE-MARK

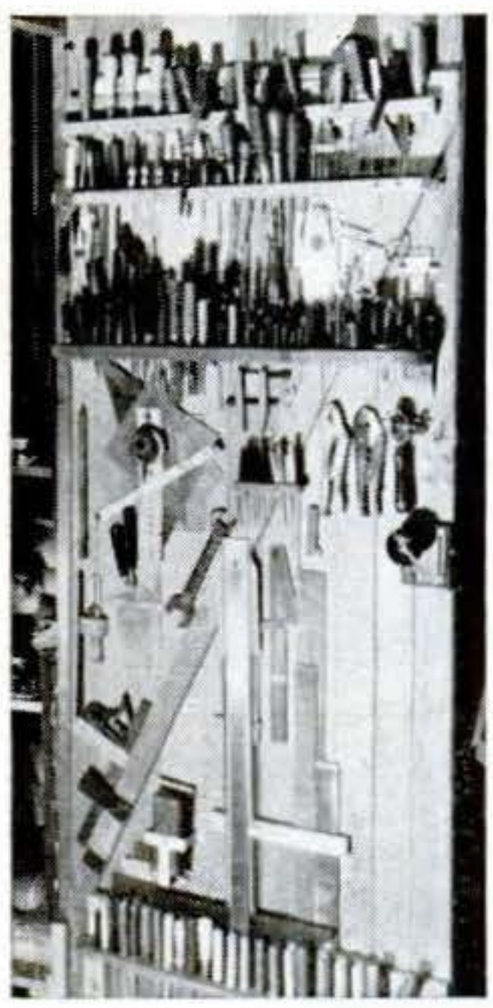
Drill Dries Paintbrush



AFTER a paintbrush has been cleaned it can be quickly spun dry with an electric drill. Make a pilot hole in the end of the handle. Cut the head off a nail and force the nail into the hole. Then chuck the other end of the nail in the drill and switch on the juice.—*Ken Murray, Colon, Mich.*

Door Serves as Tool Rack

LARGE numbers of workshop tools can be accommodated on a door. Use the door to your workshop or the side door to a garage. Install shelves, pegs and racks to suit the tools you want to store. Even squares and triangles can be handled. Reinforce the door, if necessary, and replace butt hinges with strap hinges. Secure the strap hinges with carriage bolts instead of screws—bolts will hold when screws might pull out. An extra diagonal brace on the opposite side of the door is a good idea to support the added weight.—*Hi Sibley, Nuevo, Calif.*



Toy Wagon Makes Conestoga

JUNIOR-GRADE cowpunchers will have more fun at the neighborhood roundup when they can take their own covered wagon along. The frame for the top is held to the wagon with four ¼″-20 bolts through the wagon's sides. Wagon dimensions vary but the top must be high enough to clear the heads of passengers. The bows are cut from ¾″ by 10″ lumber or plywood and lap-jointed with glue and screws to the uprights. Five slats nailed to the bows support the cloth cover, which can be an old sheet or blanket.—*Edward J. Bickel, Chicago.*

Wrap Protects Auto Bearings

WHEN you remove a bearing from a car, wrap it in clean paper until there's time to wash and inspect it. A little dust or dirt inside may easily cause scoring later.

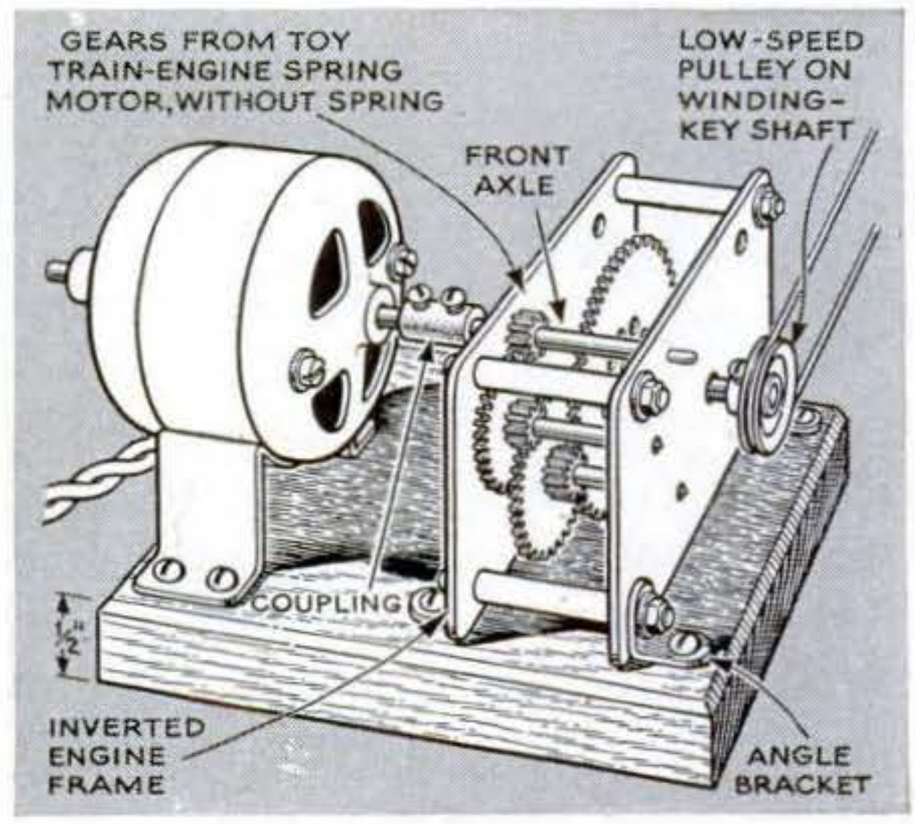
Wind-Up Motor from Toy Engine Becomes Reduction Gear

COUPLE a small motor to this little speed-reduction unit to agitate your developing tank or to power slow-moving toys, models and window displays.

The unit is made from an old toy-locomotive spring motor, using only the front axle, the gears and the winding key.

A short length of brass tubing and two setscrews link the electric motor to the gear unit. The assembly is mounted on a wood base with four angle brackets.

The motor could also be belted to the unit, obtaining additional speed reduction by using a small pulley on the motor and a larger one on the front axle of the gear train.—*Freddy Mitchell, Simsboro, La.*



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Care and Feeding of Engines

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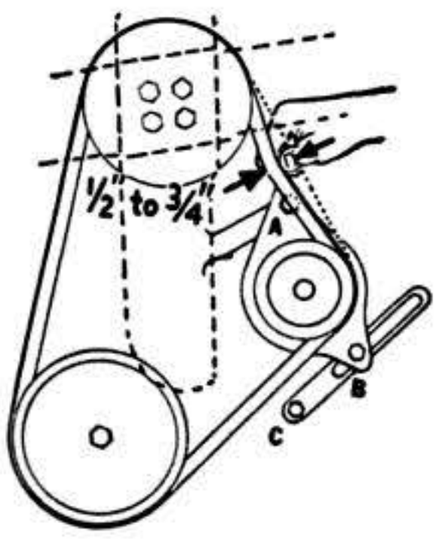
FAN BELT FACTS



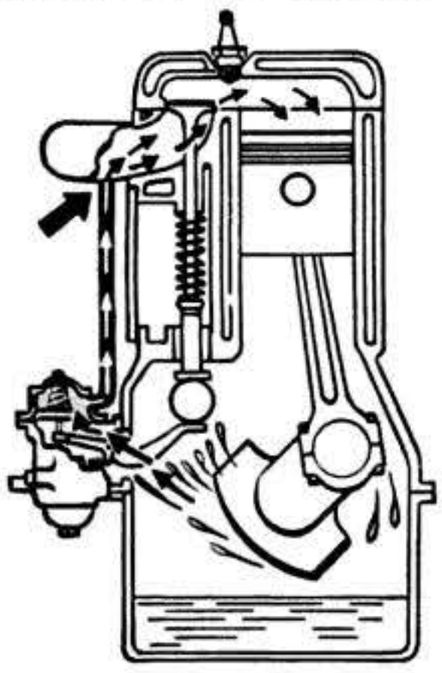
Your fan belt does a triple job. It drives fan, water pump, and generator. If too tight, it causes rapid wear of water pump and generator bearings. If too loose, it will slip, wear out too fast, permit engine to overheat, and permit battery to run down.

To replace a worn fan belt, loosen generator clamp bolts A, B, and C. Move generator toward engine, loosening belt so it can be removed. Be sure to get a new belt made for the year and model of your car. Place it on pulleys, then move generator away from engine until belt will deflect ½ to ¾ inch under your thumb, as shown. Tighten bolt B and recheck tension. If correct tighten A and C.

Even if not worn, it's a good idea to check your present fan belt often for tension.

BOOSTER PUMP CAN WASTE OIL

Most cars have a vacuum booster pump as part of the fuel pump, to maintain vacuum for the windshield wiper. If the booster pump diaphragm is cracked or damaged, oil will be drawn from the crankcase, through booster pump and vacuum line into the intake manifold, where it will mix with gas and be burned.



If your exhaust shows heavy blue smoke when you accelerate, your booster pump may be the cause. It may also cause your wiper to stop when you accelerate.

Disconnect vacuum line at point indicated by arrow. Oil in the line calls for a new booster pump diaphragm. Disconnect gas line to fuel pump. Disconnect vacuum line to windshield wiper. Remove the two cap screws holding pump to engine. Then install a replacement pump obtained from your car dealer or service station.

CHROME CAN TAKE PUNISHMENT

Late-model cars and trucks need Sealed Power KromeX Ring Sets, which use chrome in the right spots to fight heat, friction, corrosion, and abrasion. Top compression ring and steel rails of MD-50 Steel Oil Ring have chrome faces. Write Dept. H-7, Sealed Power Corp., Muskegon, Mich., for free illustrated booklet, "More Power, Less Oil, Less Gas."

Gus Goes Fishing—and Gets Hooked

[*Continued from page 150*]

". . . impossible, Lamson," Dr. Angus was saying. "I did an excellent job on the drums. They must work all right."

"Well, they don't, all the same," the other man insisted. "Every time I put on the brakes I get that thumping sound, and all the talk in the world ain't going to fix it."

Gus fought a little battle with himself there on the doorstep. Here was his chance to show Angus that nothing took the place of know-how when it came to trouble-shooting a mechanical problem. Still, this was his vacation and he'd sworn he wouldn't touch a car except to drive it.

Gus Yields to Temptation

He struggled—and lost. The doctor's cocksure attitude the night before had got his dander up. And besides, he had a professional curiosity about the thumping brakes. The combination was too much for him. He was hooked as surely as one of those trout he'd taken out of the lake the afternoon before. With a sigh of happy resignation, he walked toward the car.

"I see you're an early bird too, Doc."

Dr. Angus looked up with a frown and got to his feet. "Oh, it's you, Mr. Wilson. Yes, up early and starting the day with a problem. This is Clem Lamson—the chap who's having trouble with his brake drums."

Gus smiled and nodded a hello. "Something wrong?" he inquired. "Perhaps I can give you a hand."

"I hardly think you could be of much assistance in this case, Mr. Wilson," Dr. Angus said coolly. "The problem requires further analysis."

The Model Garageman Gets to Work

Clem Lamson looked at Gus and back to the doctor. "Let's tell him, anyhow."

Dr. Angus spread his hands. "No harm in that, I suppose. I finished the brake drums and we put them back on the car last evening before supper. But now Clem claims that his brakes make a thumping noise."

"Where does it seem to come from?"

"Can't tell rightly," said Clem, "but it sounds like the left front wheel."

"Mind if I try her out?" asked Gus.

"Nope. Reckon your guess is as good as anybody's. Let's take a little spin."

Gus drove, and the "little spin" proved that Clem was right. The thumping was

[*Continued on page 200*]

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Gus Goes Fishing—and Gets Hooked

[*Continued from page 198*]

there, all right, and Gus was sure it was coming from the left front wheel.

Back at the lodge again, the doctor looked on in stony silence as Gus went over the left front end of the car carefully. He checked the tie rods—nothing there. He examined the chassis and motor mounts.

"Got a jack handy, Clem?" Gus asked.

Clem opened the trunk and pulled one out.

"Swell, let's get this left front wheel off the ground. And Doc, could I borrow a wrench and some pliers?"

"You may," Angus replied. He turned toward the lodge.

Careful Check Fails to Spot Trouble

By the time Clem and Gus had the wheel jacked up the doctor was back with a good-sized tool box.

After the wheel had been removed, Gus took off the grease cap, pulled the cotter pin and backed off the nut that held the hub and brake-drum assembly on the spindle. Then he slowly pulled the assembly off, turned it over and inspected the bearings.

"Nothing wrong there," he announced glumly. "Well, we'd better give the brake assembly a going over."

While Clem and the Doc watched, Gus checked the whole brake assembly—springs, wheel cylinder, hydraulic lines. He had just about made up his mind that he was on the wrong track when he happened to run his fingers over the lining on one of the brake shoes. Then he quickly picked up the drum and felt its inner surface.

Gus Suggests a Solution

Just at that point, the screen door to the lodge popped open. "Thought we had an early breakfast date before some fishing, Gus," Bill Plummer called.

"Be with you in a minute, Bill." Gus turned to Angus. "Look Doc, I think if you'll chuck this drum assembly in your lathe and polish the inside of the drum with steel wool, Clem's troubles'll be over. I'll join you after I've had some breakfast."

About a half hour later, as he and Bill Plummer walked into the living room, they heard a car going off down the road. A moment later Dr. Angus walked in.

"Well, Mr. Wilson, I followed your suggestion and it worked. Clem has road-tested his car and there isn't a sign of a noise.

[*Continued on page 202*]

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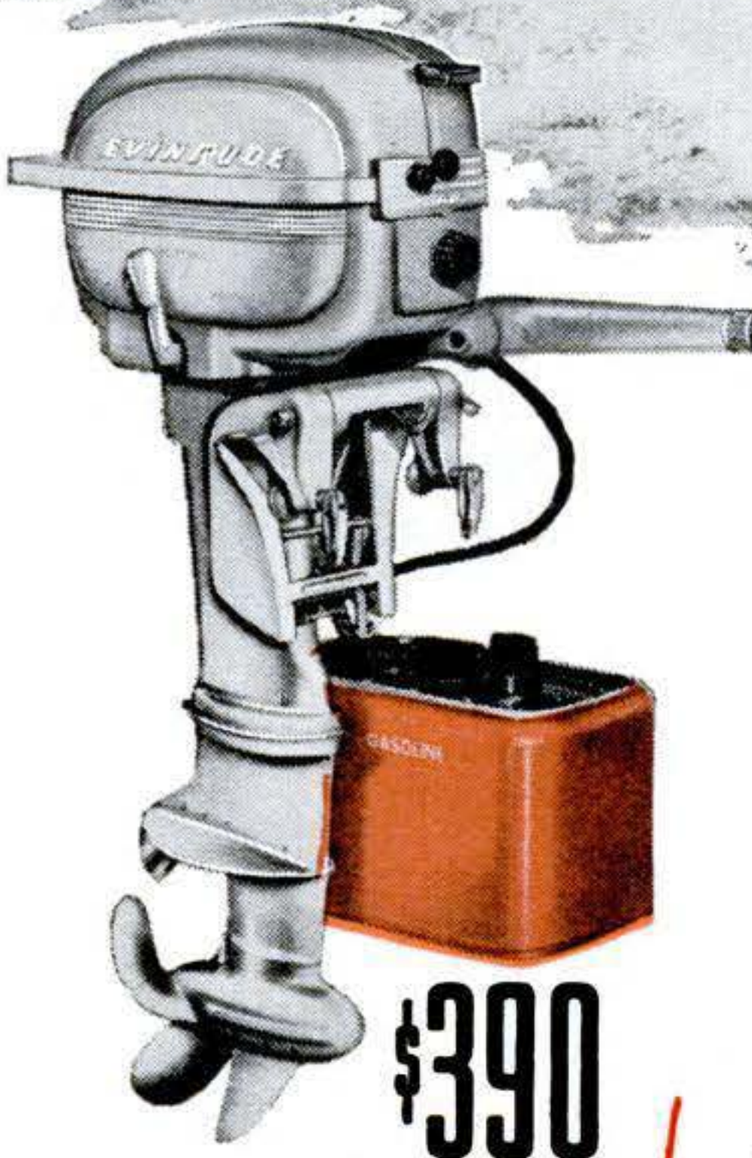

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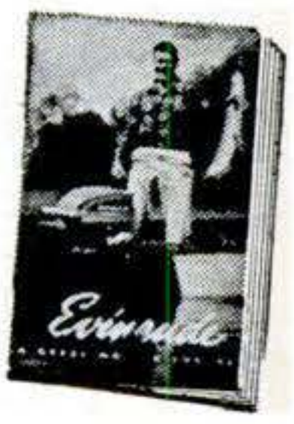

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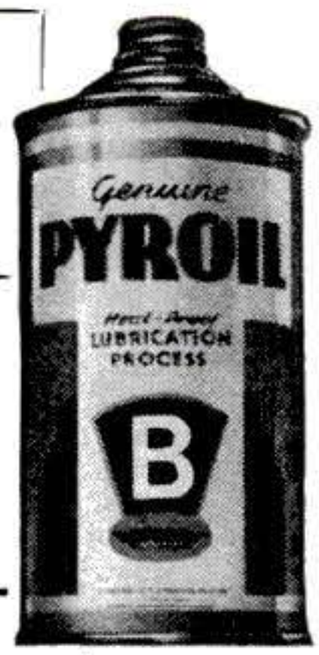
Use Aircraft Pyroil B for lubricating oil, Aircraft Pyroil A for gasoline.

GIVEN! An attractive Pyroil metal savings bank—takes coins up to 50c pieces. MOTORISTS, it's yours for the asking—sent postage paid.



Manufactured and Guaranteed by Pyroil Company, 144 Pyroil Bldg., La Crosse, Wisconsin.

Canadian Distributors: Central Purchasing Agencies, Ltd., Toronto, Ontario

PYROIL COMPANY
144 Pyroil Bldg., La Crosse, Wisconsin

I want my car to last and run properly. Please tell me more about Pyroil and how it can accomplish this for me.

Name _____

Address _____

City or Town _____ State _____

Gus Goes Fishing—and Gets Hooked

[*Continued from page 200*]

Would you be good enough to explain it?"

Gus walked over to an old phonograph in the corner of the room and picked up a record. "Here, feel this." He ran his finger over the grooves. The doctor took the record and solemnly followed Gus's example.

A Phonograph Record Proves the Point

"You see," Gus continued, "when you turned down Clem's brake drums your lathe tool left a groove similar to this on the surface of the drum. It was almost invisible, and on some brakes it wouldn't have mattered, but on Clem's it did."

"And why was that?"

"Because the brakes on Clem's car have the 'floating' type of brake shoes. They aren't anchored, but have play. As a result the grooves left by your lathe tool literally screwed the shoes out to a point where they'd suddenly snap back in again and thump against the inside of the hub."

The doctor thought for a moment. "Why didn't the same thing happen on the right wheel? I turned that drum down, too."

Gus held up his two hands. "One right and one left," he said. "The groove on the right wheel was reversed so it forced the brake shoes in rather than out, and in is their normal position. Result—no thump."

Gus Wins the Battle of the Brake Drums

For the first time since they'd met, Gus saw the doctor smile. The smile grew until you could call it an honest-to-goodness grin.

"I want to thank you for teaching me a valuable lesson, Mr. Wilson," Dr. Angus said warmly. "You know, you possess rather remarkable analytical powers, but I suspect you also have a good deal of that 'practical knowledge and experience' you spoke of last night. So you win our little argument after all. Would you mind telling me what line of business you're in?"

"Not at all." Gus grinned. "Most of the year I run a garage. But right now I'm a full-time fisherman. How about joining Bill Plummer and me this morning?"

"Why, I believe I will. By the way, Mr. Wilson, I have a theory about angling—"

"Whoa—don't tell me," Gus broke in hurriedly. "Let's not analyze *that*. Might spoil the fun. Come on, Doc, let's go catch us a mess of trout." END

Next month: Gus helps catch some hijackers.

See Why Thousands of Experts Choose These Precision Built Westcraft Tools:

Join the thousands who have discovered that famous, professional quality Westcraft tools give you the same precision engineering and lasting accuracy of other brands costing considerably more. Before you buy **any** tools, see how much more you get by shopping the complete line of guaranteed Westcraft tools . . . yours on easy terms at Western Auto!

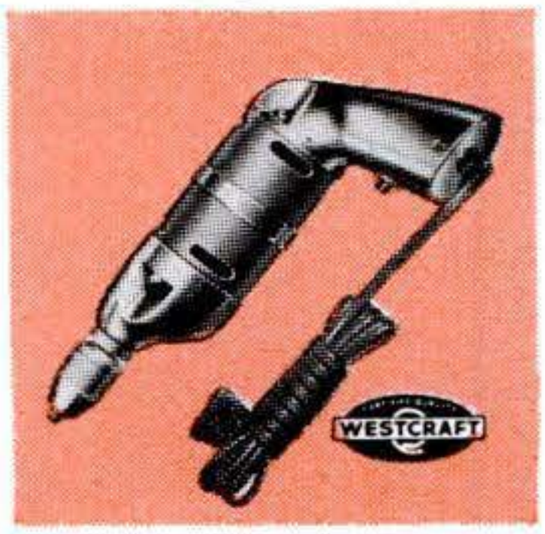
1 Tilt Table Jig Saw, cuts to center of 24" circle. Scotch yoke, oilite bronze bearings. Uses 5" pin or plain end blade ---------- (2H1102) **$19.35**

2 17-pc. Socket Set, ½" Sq. Drive. Alloy steel chrome plated. Twelve 12-pt. sockets, reversible ratchet. 5 fittings-- (HR2951) **$18.45**

3 Hacksaw, chrome-plated adjustable steel frame. Cuts to 3⅜" depth. Durable safety-grip plastic handle with 10" blade ---------- (4HR4159) **$2.25**

8-Point Crosscut Saw, 26" 4-gauge double tapered blade. Precision tempered ---- (4HR6329) **$4.85**

7" Lobster Claw Plier. Patented design gives 50% more gripping power -------- (HR1125) **$1.25**



¼" Electric Drill, Cutler-Hammer switch, steel-cut gears, 3-jaw chuck. 1 yr. guarantee (2H1379) **$12.25**

14-Piece Accessory Kit with attachments for sanding, polishing, grinding, etc Steel tool box---- (2H1378) **$4.69**

Professional Quality—Wizards of Performance

WESTCRAFT TOOLS

Sold by the largest group of associated tool departments in America.

WESTERN AUTO STORES & ASSOCIATE STORES Sold Only By

NOTE: Western Auto Associate dealers own their own stores and set their own prices, terms and conditions. Prices may vary due to differences in local conditions. If you do not know the location of your nearest Western Auto Store, write Western Auto Supply Co., 2107 Grand, Kansas City, Missouri. (PS72)

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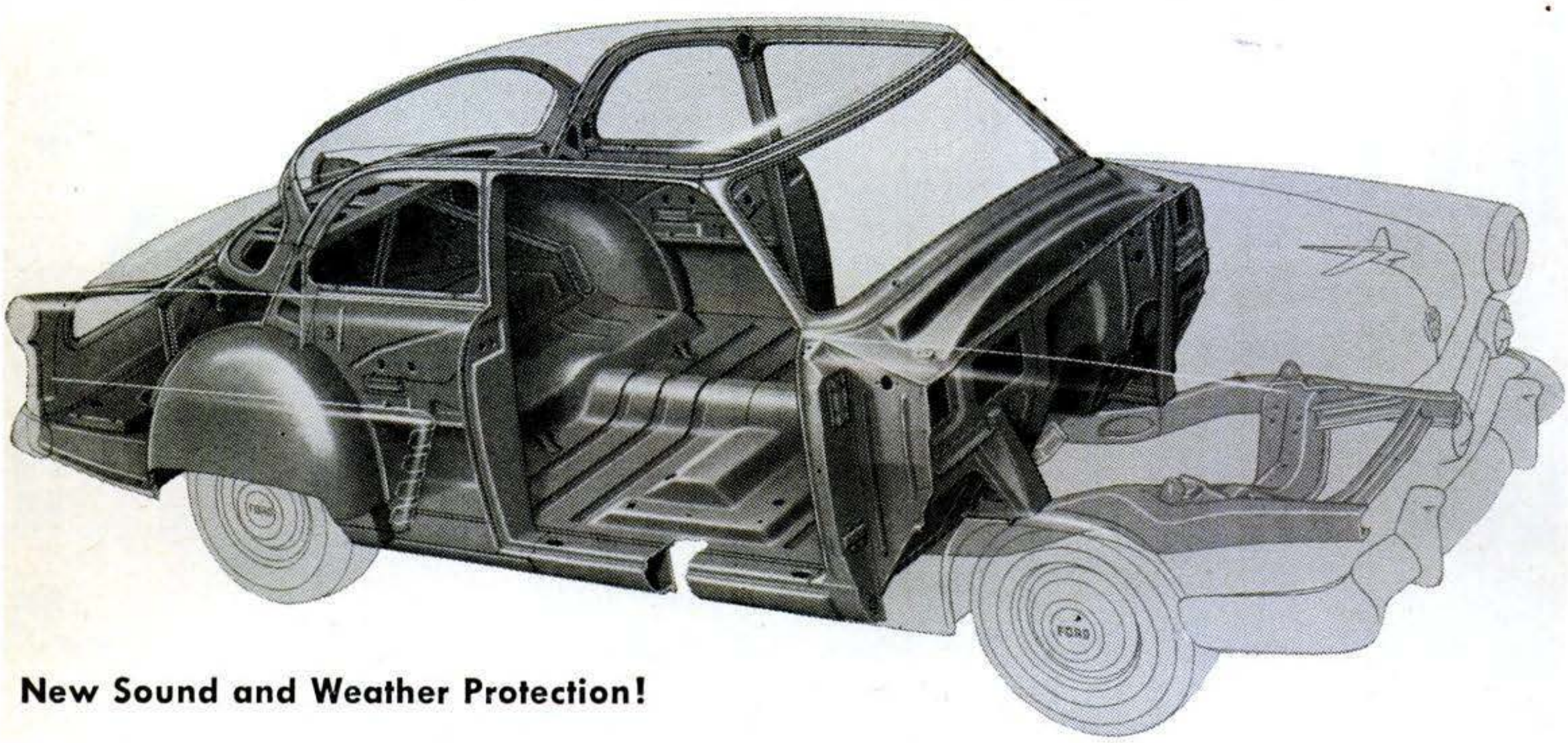
The inside story of Ford's

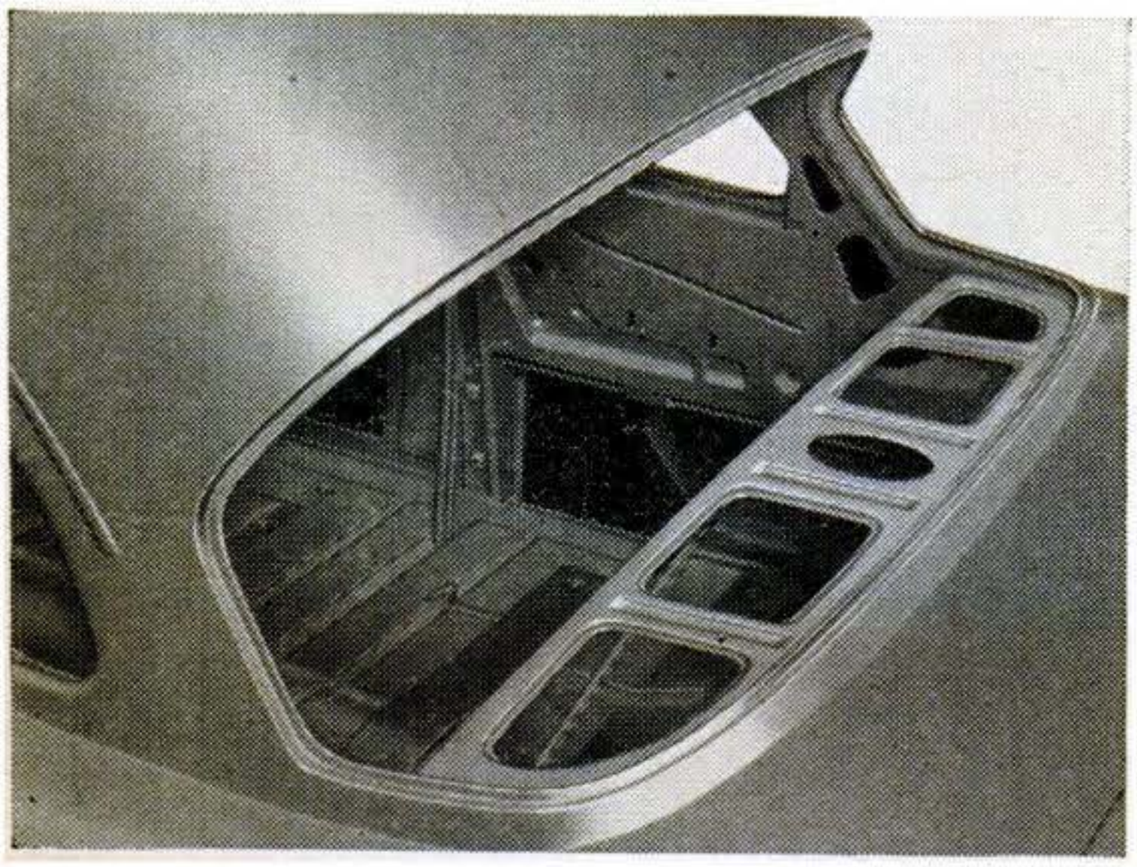
"New design makes Ford bodies the most

Balanced design! "The ideal in correlation of structural members has been achieved in the '52 Ford. The body unit provides more usable space, unusual visibility, modern beauty . . . *plus* added strength for greater safety and longer life."

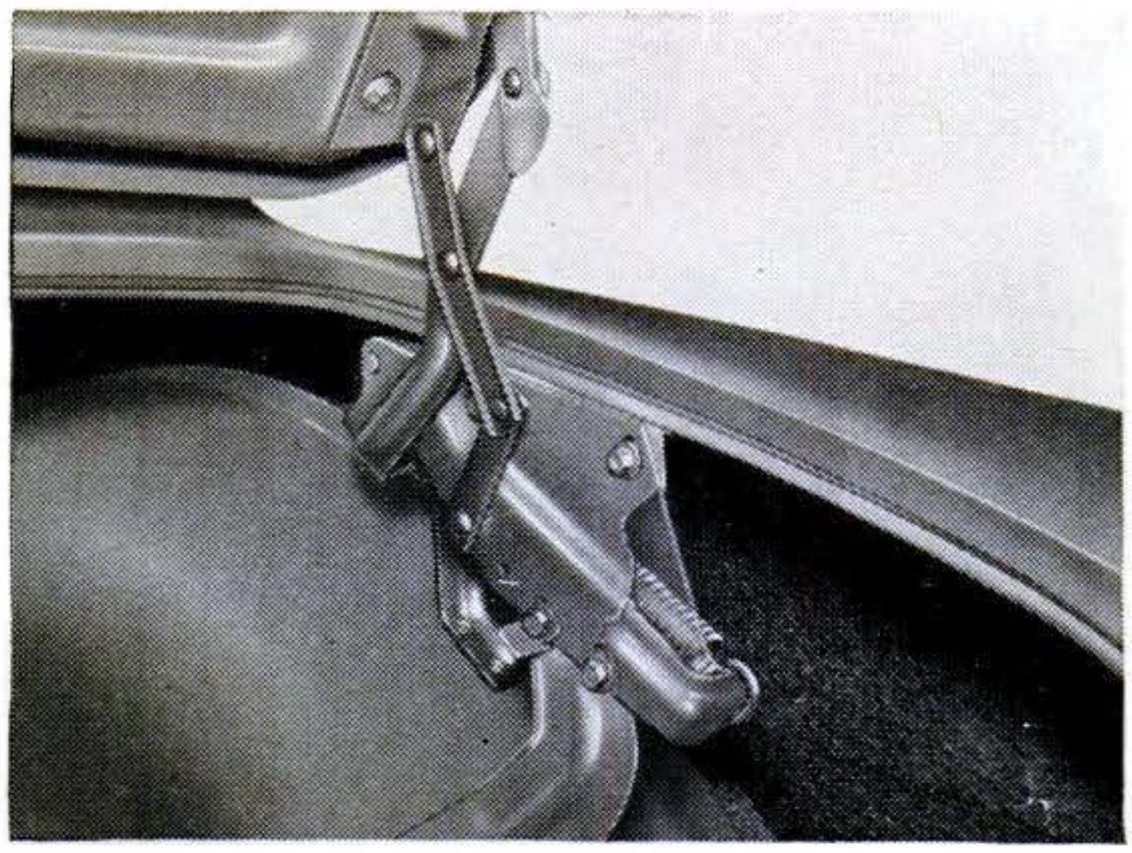


New Sound and Weather Protection!

"An important quality feature of the new Ford bodies is their superior insulation against sound and weather. Glass fibre, heavy asphalt impregnated waffled felt pads and mastic sound deadeners are used to damp out mechanically induced sounds. Even the body bolts are insulated with rubber to keep out road noises. A new design door inner panel with continuous rubber strip provides effective sealing against rain and dust."



Full Visibility plus extra strength! "3200 square inches of glass give true Full-Circle Visibility . . . 16% more than any other car in Ford's field. Windshield and rear window are completely encircled by husky box-section structures welded to roof rails and other members for greater strength."

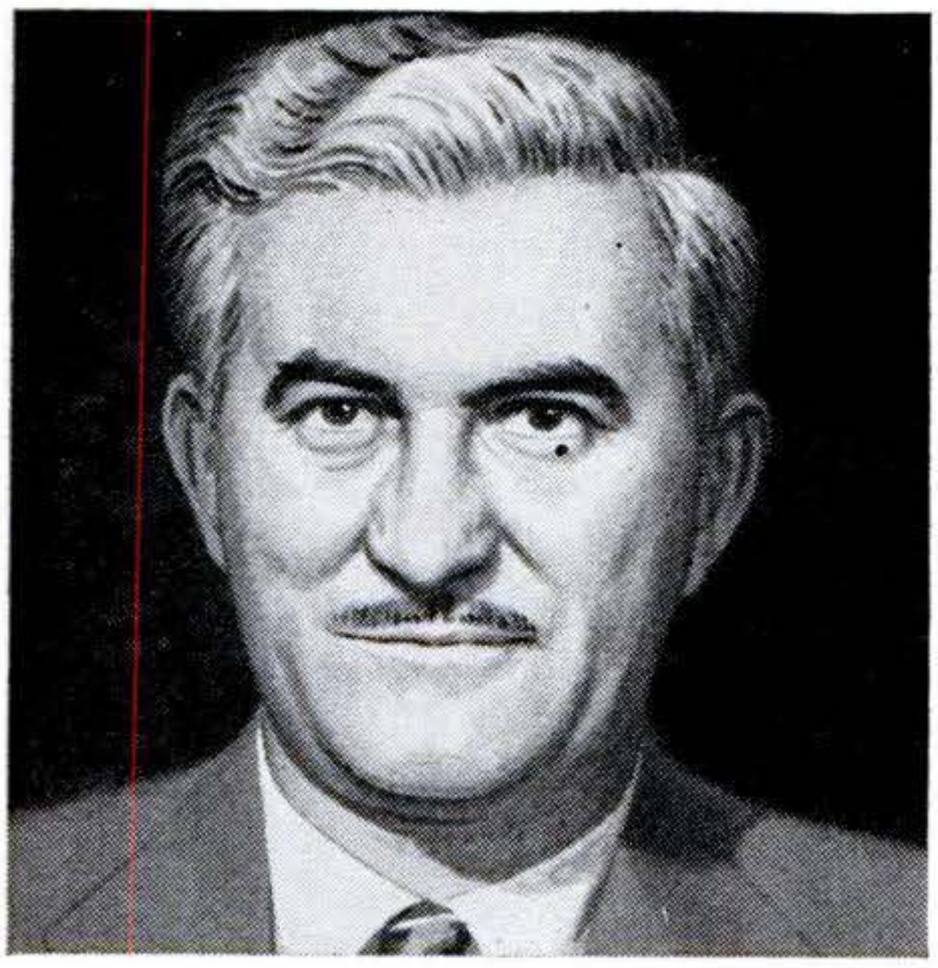


More usable room! "By taking advantage of the wider and longer body shell, Ford body engineers have achieved the maximum usable passenger and luggage space. For example, the new Space Saver Hinges and Center-Fill Fueling with its shorter fuel pipe make possible the roomiest trunk in Ford's field."

Copyrighted material

modern body construction

advanced in their field," says Dr. Roy K. Marshall.



A PICTURE STORY BY DR. ROY K. MARSHALL

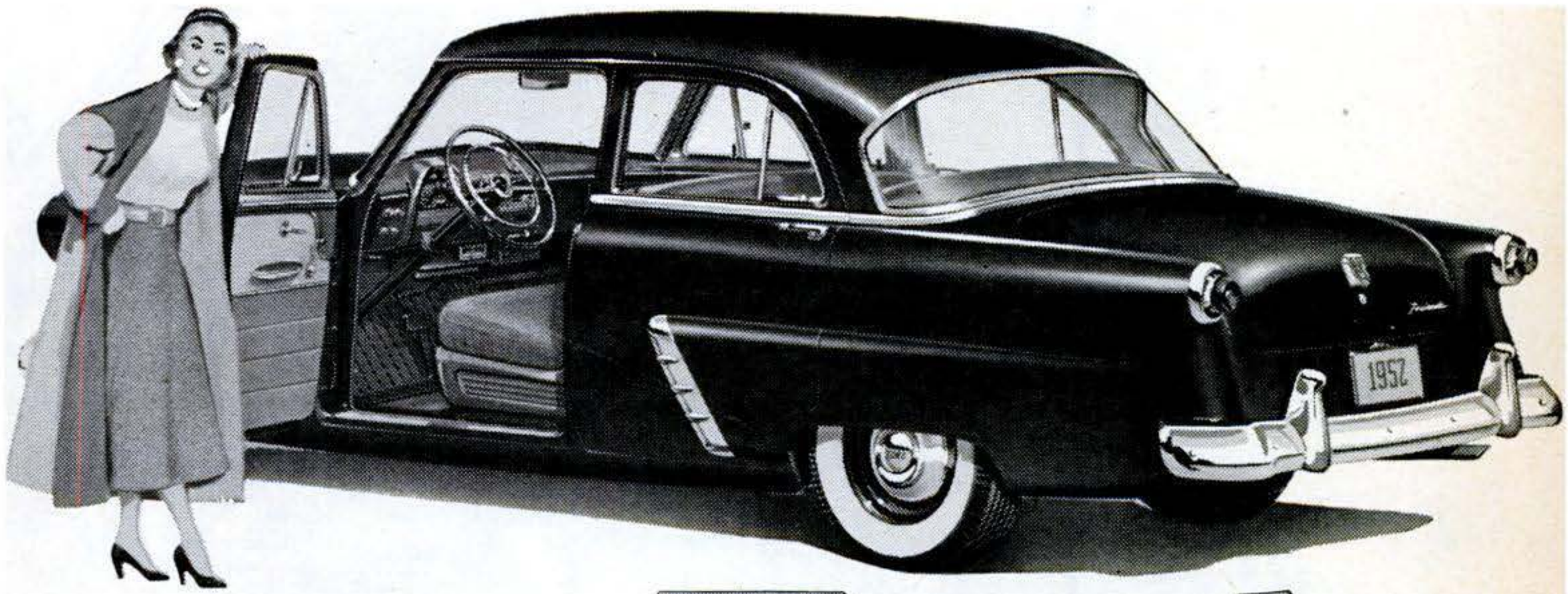
Dr. Marshall is a former consultant to the Atomic Energy Commission and a well-known lecturer. He is nationally famous for his simplified explanations of complicated things.

"FOR YEARS TO COME you'll see others follow the design and construction trend started by Ford body engineers.

"The completely new body is a masterpiece of balanced design, with its structural members welded into a unit of strength and beauty never before achieved in the automotive field. For very often, beauty had been sacrificed for strength, or rigidity had been sacrificed for beauty's sake. In the '52 Ford, however, you get a remarkable blending of the two in master coachwork by Ford's master craftsmen."

Over 200 combinations

"When you visit your Ford Dealer notice the careful tailoring of the rich long-wearing upholstery fabrics . . . all color-keyed to interior trim and exterior colors. From more than 200 body, color and upholstery combinations you can choose the one best suited to your taste and your needs."



You can pay more

but you can't buy better!

Ford

White sidewall tires and heater optional at extra cost. Equipment, accessories and trim subject to change without notice.

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How You Become a Flying Radar Man

[Continued from page 108]

He found cadet columns swinging along singing the Air Force songs. At first it seemed to him like Hollywood corn. Soon he found himself joining in, and liking it.

Military training, which he'd had before, was a breeze to him. His earlier math and engineering helped with the academic part. New to him were many studies—weather, communications, instruments, navigation, electronics and radar systems—but he stood third in his first comprehensive examination. He remained among the top 10 for the duration of the course.

When the ground training reached airborne radar instruments it really got interesting. The future observers took apart and reassembled the sets they'd soon be using.

Ground Targets Make Blips

With a hand control, they practiced manipulating a radar antenna the way you would an auto spotlight. In the classroom, a simulated target moved in front of the cone-shaped field of "vision" and showed up on the scope as a luminous blip.

Watching the position of the blip, as shown by faint hairlines forming scales, cadets learned to give an imaginary pilot verbal directions that would keep a plane headed toward a target. They found out how to gauge the target's speed of approach by the blip's rate of movement past a range scale, and to recognize its type of flight—approaching head on or from right angles, for example.

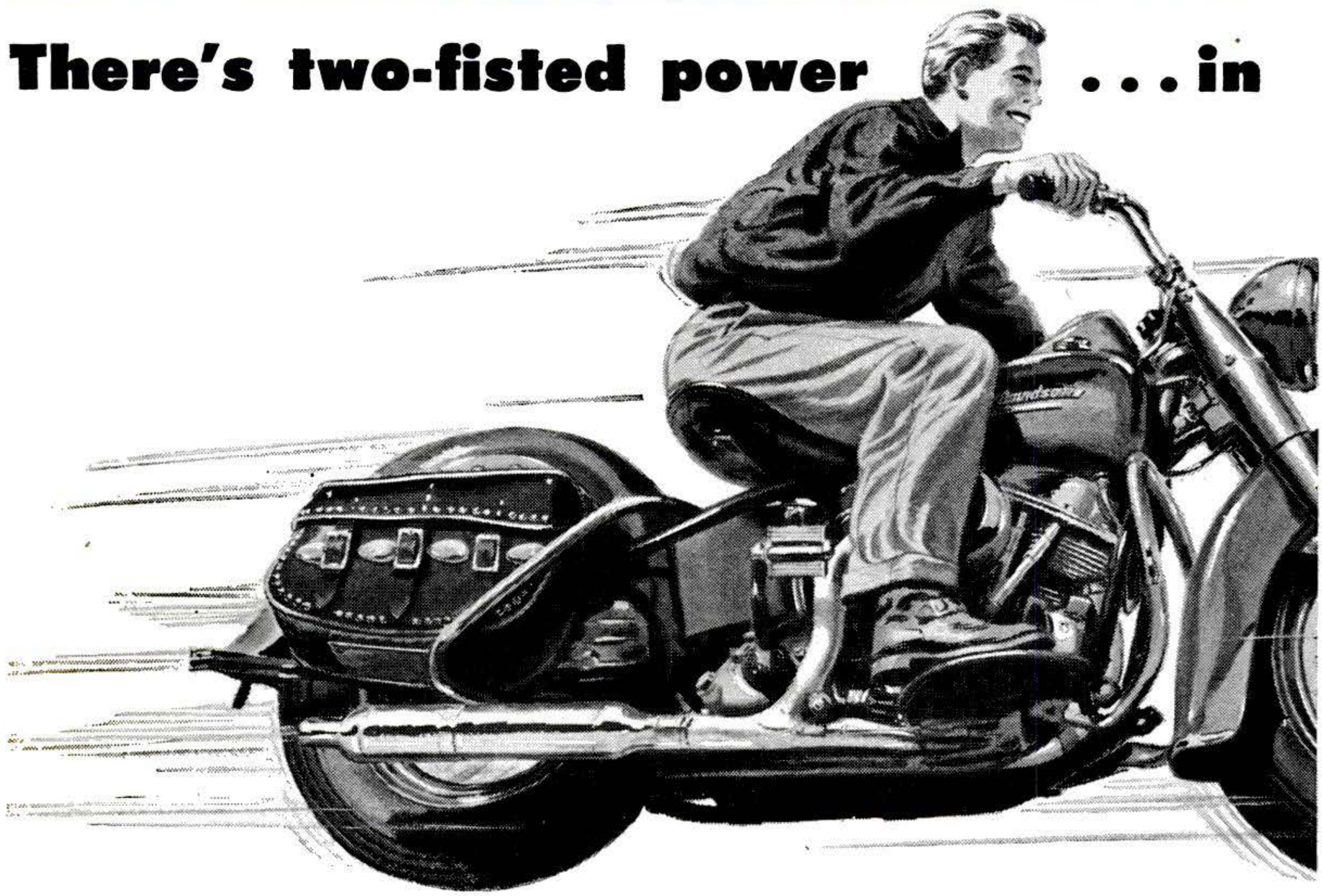
From their hard, creaky folding chairs they practiced running intercepts and learned the orthodox approaches in day- and night-fighter tactics. After a few dozen hours of this, they were itching to get up there in a plane and try it.

At last the time came for Floyd to go up, along with two other students. Floyd sat at the No. 1, or control, radar set, his instructor behind him at set No. 2. A second student kibitzed at a radar set in the tail; the third sat with the pilot and copilot in the nose, watching the target ship. Their turns at set No. 1 would come later.

In the air, the instructor ran off a few sample intercepts. Then:

[Continued on page 208]

There's two-fisted power . . . in

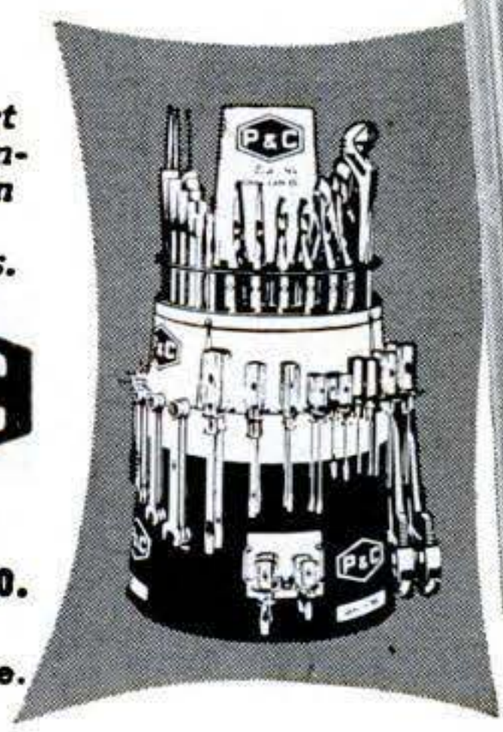


P & C Hot Forged Tools

make tough jobs EASY!

Built by master craftsmen, P & C tools are "muscle saving" and "fun to use." They get into small openings, fit nuts and screws snugly, balance perfectly in the hand. And special analysis alloy steels plus scientific heat treating makes them stay on the job longer. Look for the P & C rotary tool display unit and get "the *best* tools money can buy."

Write for handy pocket catalog. Complete data on some 300 P & C Tools.

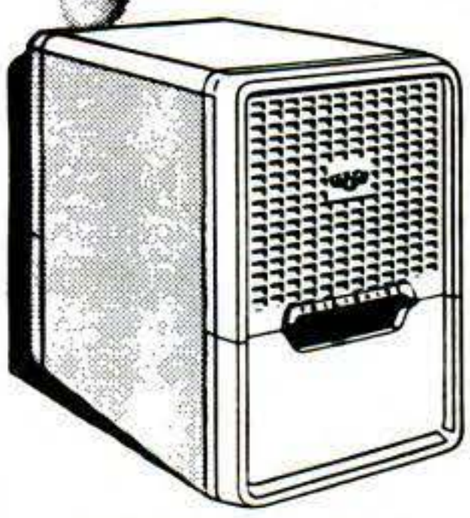


P & C

P & C Hand Forged Tool Co.
Box 5926 F
Portland 22, Ore.

KEEP YOUR TOOLS FREE FROM RUST!

THE FRIGIDAIRE ELECTRIC DEHUMIDIFIER
ends moisture damage in Workshops, Basements, Darkrooms

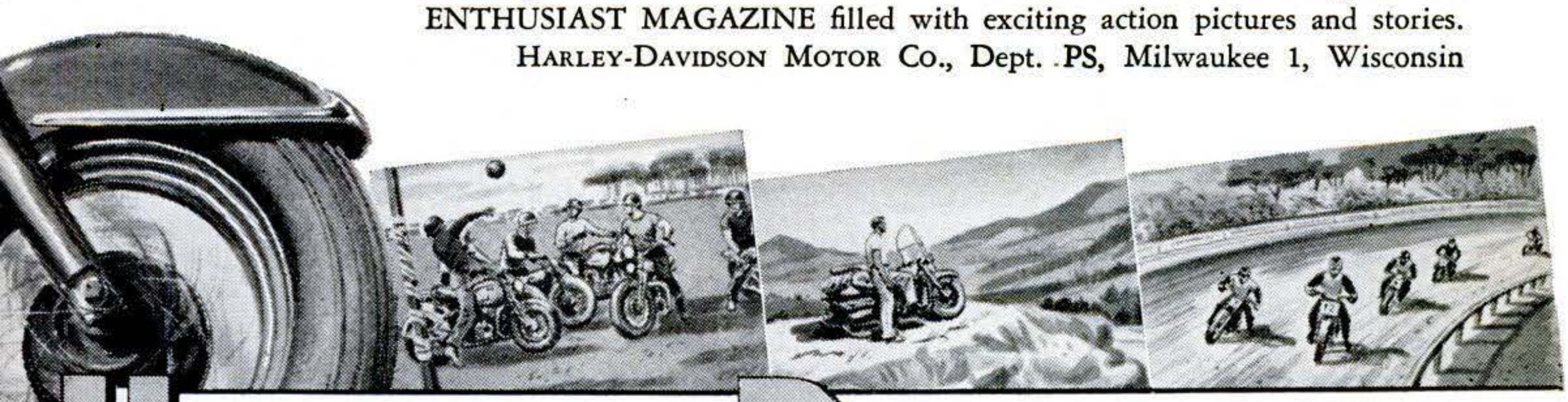


Compact size—put it anywhere—18¼" high—20½" long—11¾" wide

Put a permanent end to moisture damage the instant you plug in this amazing device. Stops mold, rust, mildew. Protects equipment, luggage, furniture. Positively controls moisture in any closed area up to 8,000 cubic feet. No messy chemicals to bother with. Operates on pennies a day. Uses refrigeration principle. Powered by world-famous Frigidaire Meter-Miser compressor with 5-Year Protection Plan. See your Frigidaire Dealer or write for special folder giving full details. Frigidaire Division, General Motors Corp., 1528 Amelia St., Dayton 1, O.

this great motorcycle !

If you like a sky-hootin' scamper — or the thrill from barreling along on a straight stretch, throttle up on the Harley-Davidson Big Twin. You'll get a spine-tingling kick out of the zooming power, the breath-taking dig-out, the sensational performance of your mount. Treat 'em rough — pound out the miles — enjoy 'em to the hilt. No matter where you do your riding — at scrambles, club events, speed trials, field meets, or on vacation trips, the Harley-Davidson Big Twin is for *you*. See your dealer today and take your buddy along. Or send 25¢ for literature on latest models and a copy of the ENTHUSIAST MAGAZINE filled with exciting action pictures and stories.
HARLEY-DAVIDSON MOTOR CO., Dept. PS, Milwaukee 1, Wisconsin



HARLEY-DAVIDSON
HYDRA-GLIDE®

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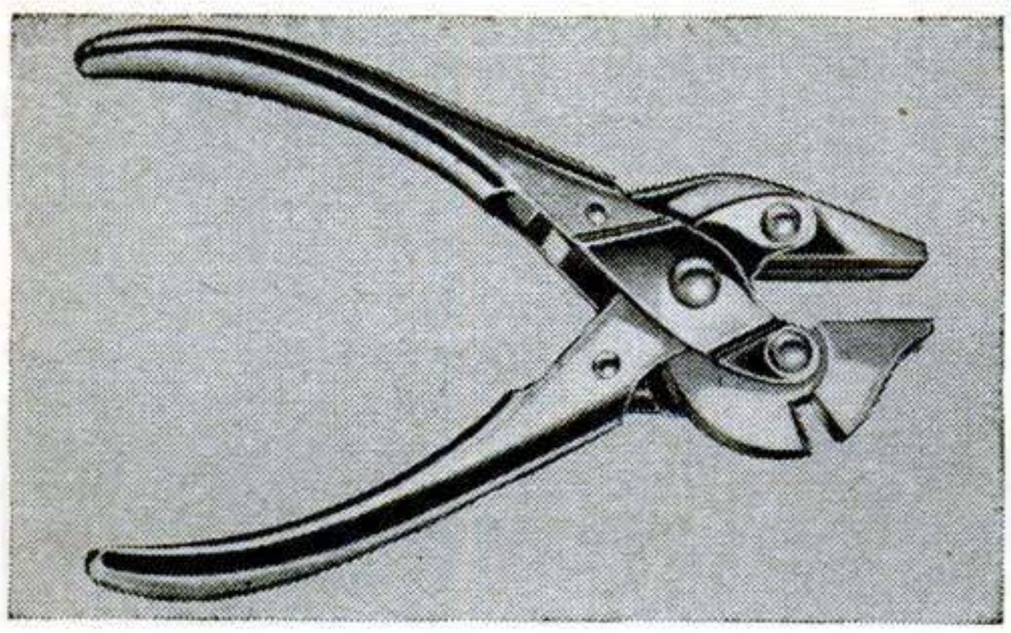
Get the PLIERS with the

SARGENT

Parallel-Action Pliers



Extreme Gripping Power is developed by compound leverage . . . parallel jaws take hold like the jaws of a vise.

Outside Cutters cut wire even when it lies tight against a flat surface.

Open Throat permits wire pulling and many other operations that are impossible to do with other types of pliers.

Riveted Assembly assures permanent adjustment of cutting blades and jaws.

See them in 4½", 5½", 6½" and 8" lengths at your hardware dealer or write for details. Dept. 26G.

SARGENT of New Haven ®

SARGENT and COMPANY

New York • New Haven, Conn. • Chicago

The Tops in Tools...The Latest in Locks

How You Become a Flying Radar Man

[*Continued from page 206*]

"All right, Mr. Few. You take over now."

It felt good to be handling the plane. Even though, as Floyd told me later, "There were just too many things to do for a guy with only eight hands." Eleven controls on the panel, plus the scope and two meters, make 14 things to keep track of. Small wonder if a beginner sometimes gets confused and hits the "panic button."

Calling the pilot's every move, you must keep up a chatter as rapid-fire as a radio announcer's. This is what it sounds like:

Closing in on a Bogey

"Contact, 30 degrees port, range umpty-ump yards, five degrees above, closing speed 40 . . . (You're closing in on a target to the left and above at 40 miles an hour, and give the range in yards; the figure is left out, here, for security reasons.)

"Port easy . . . level off . . . nose up . . . increase speed . . . bogey now umpty-ump yards . . . all possible speed . . ." The chase is narrowing and the bogey tries vainly to shake you off by making a right turn.

"Easy starboard . . . hard starboard . . . ease off . . . you are now at umpty-ump yards . . ." And so it goes until the jet is in position to open fire.

Students learn to follow a bogey making mild evasive maneuvers—then violent ones, turning and weaving in every imaginable fashion. That means a wild ride like the one that introduced Floyd to us. Afterward come critiques in which a student learns his mistakes, and how to avoid them next time. Standards are sky-high and a point system based on training flights, check flights and exams eliminates the weak sisters.

Jets Next Stop

Those who have made the grade, like Floyd, graduate from prop-powered bombers to F-94 jets for four weeks of training with seasoned jet pilots at Tyndall Air Force Base in Florida. Then, out to operational squadrons.

Practice will never be over for them. It takes constant day-and-night flying to stay at the peak. Members of these all-weather interceptor crews take it in dead earnest. A lot depends on one man—he may be the one responsible for knocking down an atom bomber that could have wiped out a U. S. city. It could be Floyd or any one of them.

END

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Hammer Test shows how--

THAT CUSHIONY FEELING LASTS LONGER WITH MARFAK Lubrication

Hit *Marfak* with a hammer, and this tough, stretchy lubricant won't splatter or spread—as will an ordinary lubricant. Instead, *Marfak* forms a "collar" around the hammer face. This shows how longer lasting *Marfak* chassis lubricant *stays* put, protects, clings to points of wear and friction. *Marfak* lasts for a thousand miles or more! It's specially compounded to resist jar-out and squeeze-out in spite of roughest going. Resists wash-out, too. That's why *you* enjoy "cushiony" driving that *lasts*. For *Marfak* lubrication, see your Texaco Dealer, *the best friend your car ever had.*

TEXACO
REG. T. M.

THE TEXAS COMPANY

TEXACO DEALERS IN ALL 48 STATES

Texaco Products are also distributed in Canada and in Latin America

Faithfully yours 50 *for Fifty Years*

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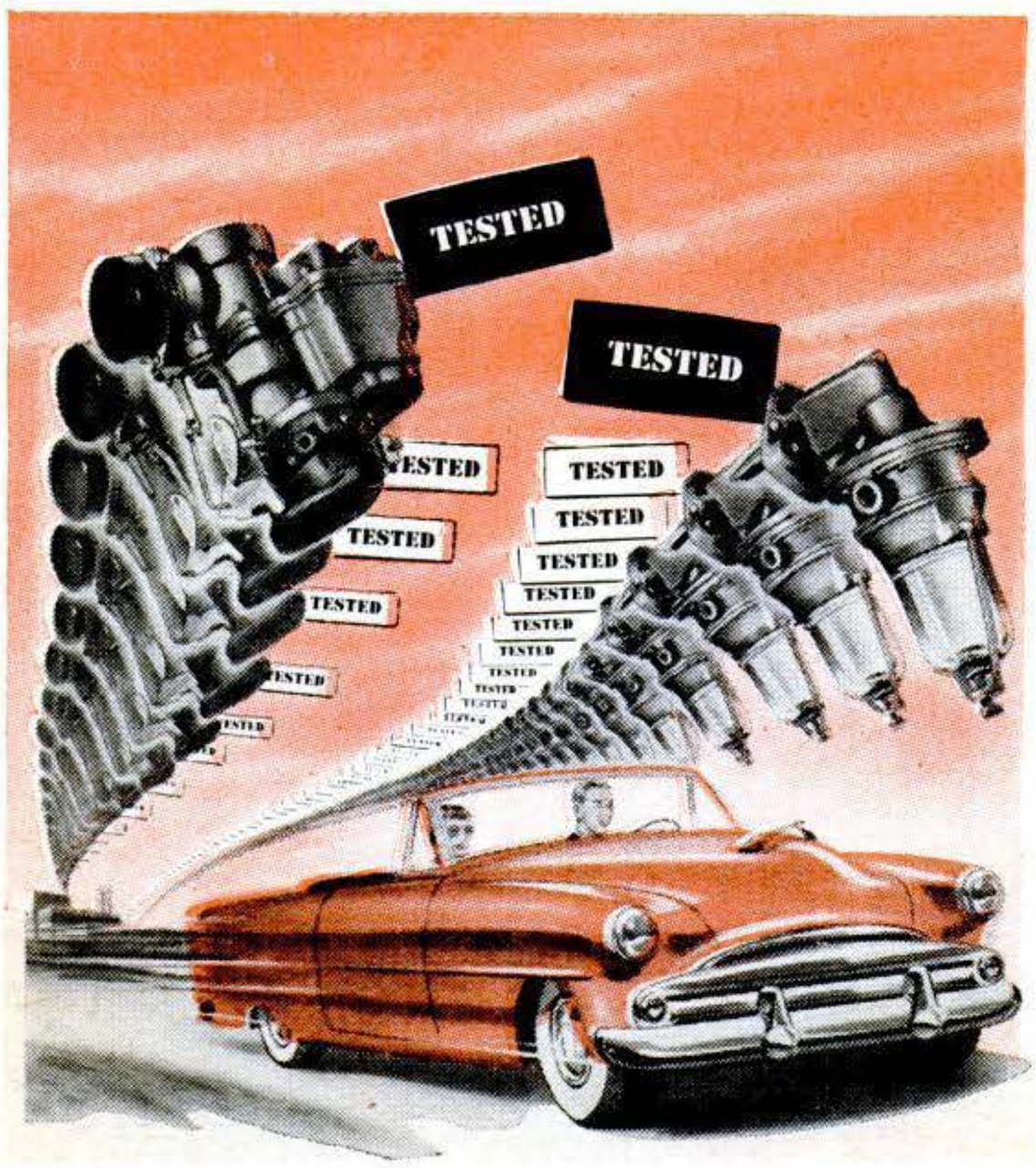

For Your PROTECTION

EVERY

CARTER

POWER CENTER

CARBURETER and FUEL PUMP

is individually TESTED before it leaves our factory

When you buy a Carter Carbureter or Fuel Pump in the original package, you get brand new, pre-tested equipment — NOT a so-called factory rebuilt.

For your protection and motoring pleasure look in the classified section of your phone book under CARBURETER for the service shop or dealer nearest you.

YOU GET A LIBERAL TRADE-IN ALLOWANCE ON YOUR OLD CARBURETER AND FUEL PUMP

CARTER CARBURETOR CORPORATION
St. Louis 7, Missouri
Division of American Car and Foundry Company

$1,000,000 Firms Grow from Hobbies

[Continued from page 70]

Navy Office of Information in Washington he got the latest markings used on the plane and the colors it was painted.

Now the SNJ was ready for designing. Bill turned this job over to Henry Struck, five-time national scale-model champion. Three weeks later, Struck brought over an actual model that he had constructed, plus a drawing.

The SNJ, like most such models, contains four types of parts: metal fittings, molded plastic parts, decals for the markings, and the wood pieces. The first three are manufactured by outside firms to specifications provided by Bill. All the woodworking, however, is done at the plant by a crew of nine operating power gang saws, shapers, and specially built cutting instruments.

Parts Are Packaged

Final stage is the assembly line. Some 25 girls sit at a long bench, with stacks of parts piled in front of them. As cartons move along the line, each girl inserts the right pieces. Then out they go to the dealers. Price for the complete kit: $4.95. Engines, bought separately, cost from $5 to $17.

Now, what are the chances for newcomers in this spurting industry—what are the opportunities for the young hobbyist, interested in putting together the pieces others create, to make and sell his own kits?

Field Is Wide Open

Says Gordon Varney of Chicago, whose Varney Scale Models is one of the largest in the industry: "The outlook for a young man is good. There are literally myriads of small items and gadgets which have not yet been touched.

"I would say this: Don't copy existing items. There are too many things that have yet to be done."

How about some suggestions?

"Sure," says Varney. "Electrical gadgets that move are swell, such as an old water mill, a gantry crane, electric signs, windmills, pumping oil wells. You can name hundreds of others."

Ralph P. Johnson, executive director of the Model Industry Association, the industry's trade group, agrees it is an up-and-coming field which a young man could enter with high hopes of success.

Says 26-year-old Jerry Brofman, founder

[Continued on page 212]

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Don't get stuck with a rust-clogged radiator!

Drain it out, then clean it out. Avoid overheating!

DU PONT Cooling System CLEANSER

Summer is the season when your cooling system must work hardest to prevent engine overheating. That's why it's so important *now*, to be sure your cooling system is really clean. **Du Pont Cleanser** safely and easily removes all the rust that causes trouble. You can even let it work while you're driving. Neutralizer is included in the same can, and there's *no reverse flushing necessary!* Ask for Du Pont Cleanser at your auto supply store today . . . or ask at your service station about the complete Du Pont "Drain Out" service.

After cleaning, prevent rust all summer long with

NEW DU PONT ANTI-RUST and Water Pump Lubricant

It's a cinch to keep new rust from forming in your radiator with **Du Pont Anti-Rust.** This new liquid rust inhibitor not only prevents corrosion, but neutralizes acids, lubricates the water pump and helps eliminate squeaks. It won't clog or cause sludge . . . is harmless to hose and metal parts.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

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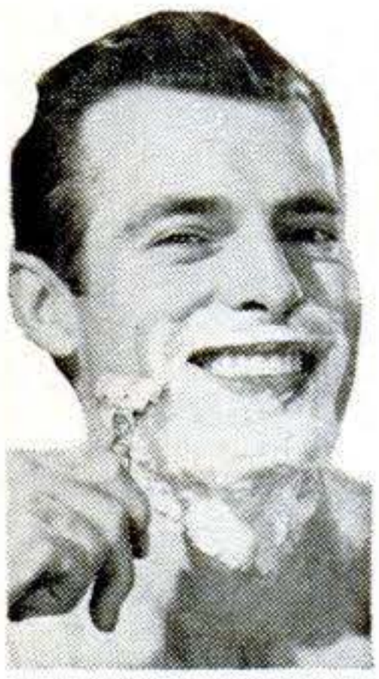
YOU SHAVE CLEANER IN ½ THE TIME

"Get it over with" fast with Schick Injector, world's only razor specially engineered to give you "Twice Over" smoothness with "Once Over" Shaving!



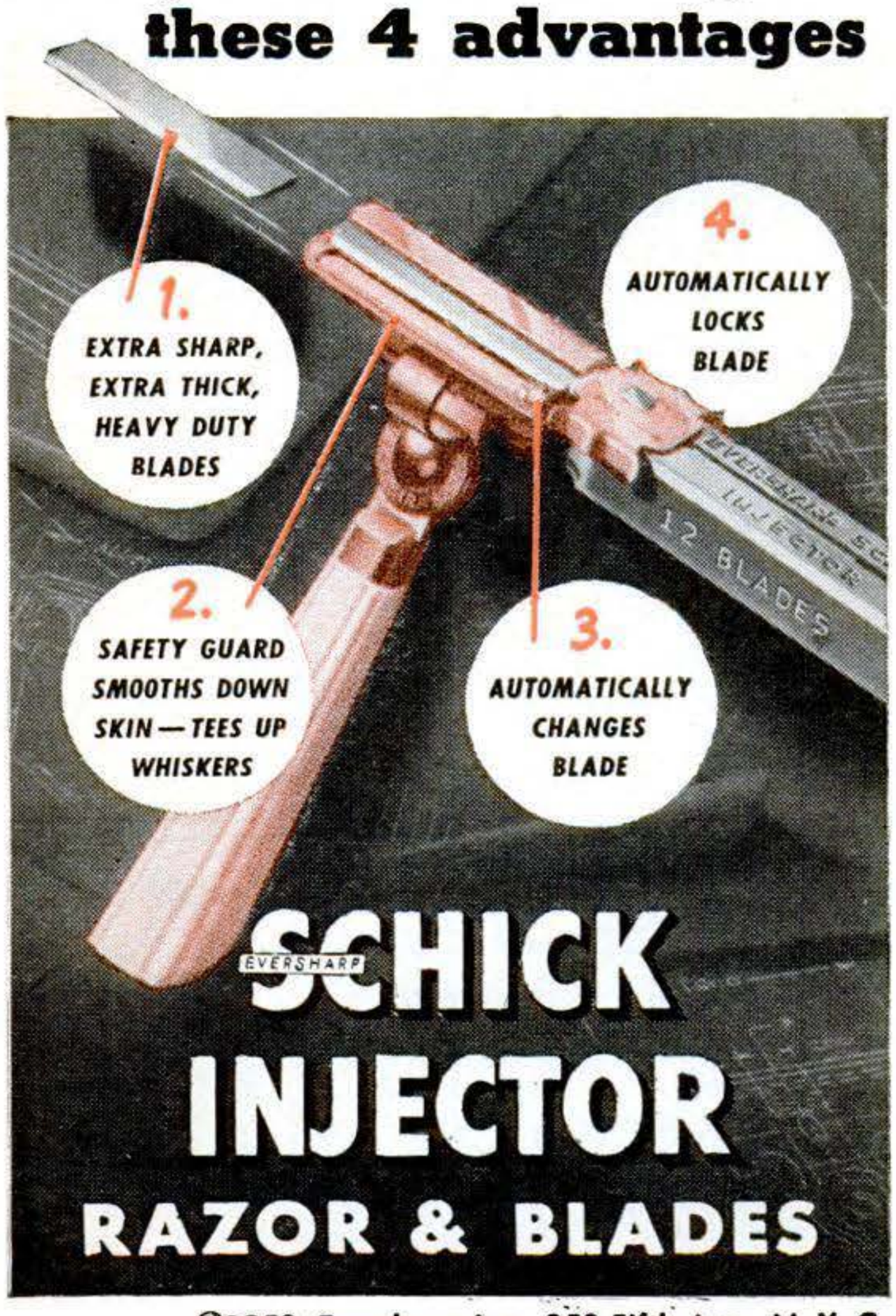
No movable parts that get out of adjustment, no detachable parts that can be dropped or misplaced. Specially designed to "fit" your face—under nose, around lips!

Today, get your complete razor kit:

- ★ Gold-Plated Razor
- ★ 12 Scalpel-sharp "Gold Pack" Blades
- ★ Handy Travel Case

Big $1.75 Value. Now Only **98¢**

Only razor offering these 4 advantages



©1952, Eversharp Inc 350 Fifth Ave., N. Y. C

$1,000,000 Firms Grow from Hobbies

[Continued from page 210]

of the Enterprise Model Aircraft and Supply Co. of Brooklyn: "It's not easy—you need lots of know-how and lots of experience, but if you stick to it, you can succeed."

Maybe you want more inspiration—then stand by while the parade of success stories continues to pass in review:

Lud Kading and John Broadbeck are the K & B of the K & B Manufacturing Co. of Compton, Calif. Although only a few years old, their company is selling more than 100,000 "half-A" engines yearly for kit-assembled planes.

Jeep Started Big Business

Gordon A. Babb, head of Ace Products in Pasadena, Calif., sold 1,800 jeep kits in 1942. This year he expects to sell 600,000 jeeps, hot rods, T-rods, midgets and roadsters.

Clyde Austin and his wife, Vera, who run Austin Craft of Burbank, Calif., make all sorts of vehicles that were used in the rip-roaring Old West: buckboards, ranchito carts, covered wagons, stagecoaches.

Eli LaCaille, head of the Frontier Novelty Manufacturing Co. of Los Angeles, also creates remembrances of pioneering days. Last year his sales totaled 85,000 models.

Thomas J. Ayres puttered with model railroads as a boy. Today Ayres Scale Models of Garden Grove, Calif., has a yearly sale of 50,000 kits in the railroad line.

Peter Pan Makes Money

And there's John D. Frisoli. His Scientific Model Airplane Co. of Newark, N. J., begun in a 12-foot-square store, now makes plane and boat kits, racing cars and accessories, and expects to do $200,000 worth of business this year.

Remember Peter Pan, who never wanted to grow up because it was too much fun just being a boy? The guys at the top in this fabulous new industry are spiritual descendants of the wistful Peter—they happened to grow up, but they're still having the fun they had as boys. Plus profits, which is something young Master Pan never had. END

Protecting Electric Cords

To KEEP the fabric covering on an electric-appliance cord from fraying near the ends, coat the edge with shellac before the cord is connected inside a plug or socket. Shellac is an excellent insulator.

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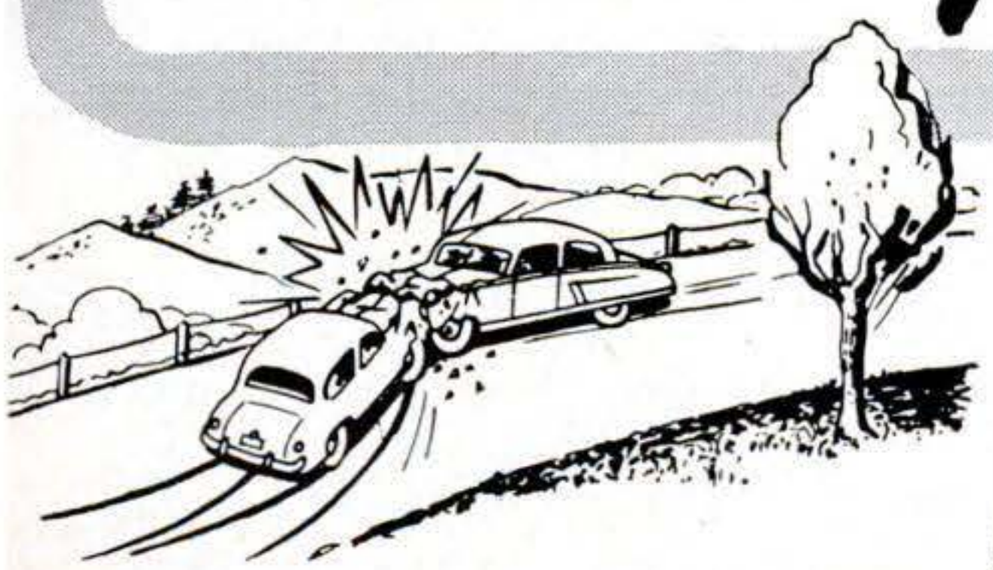
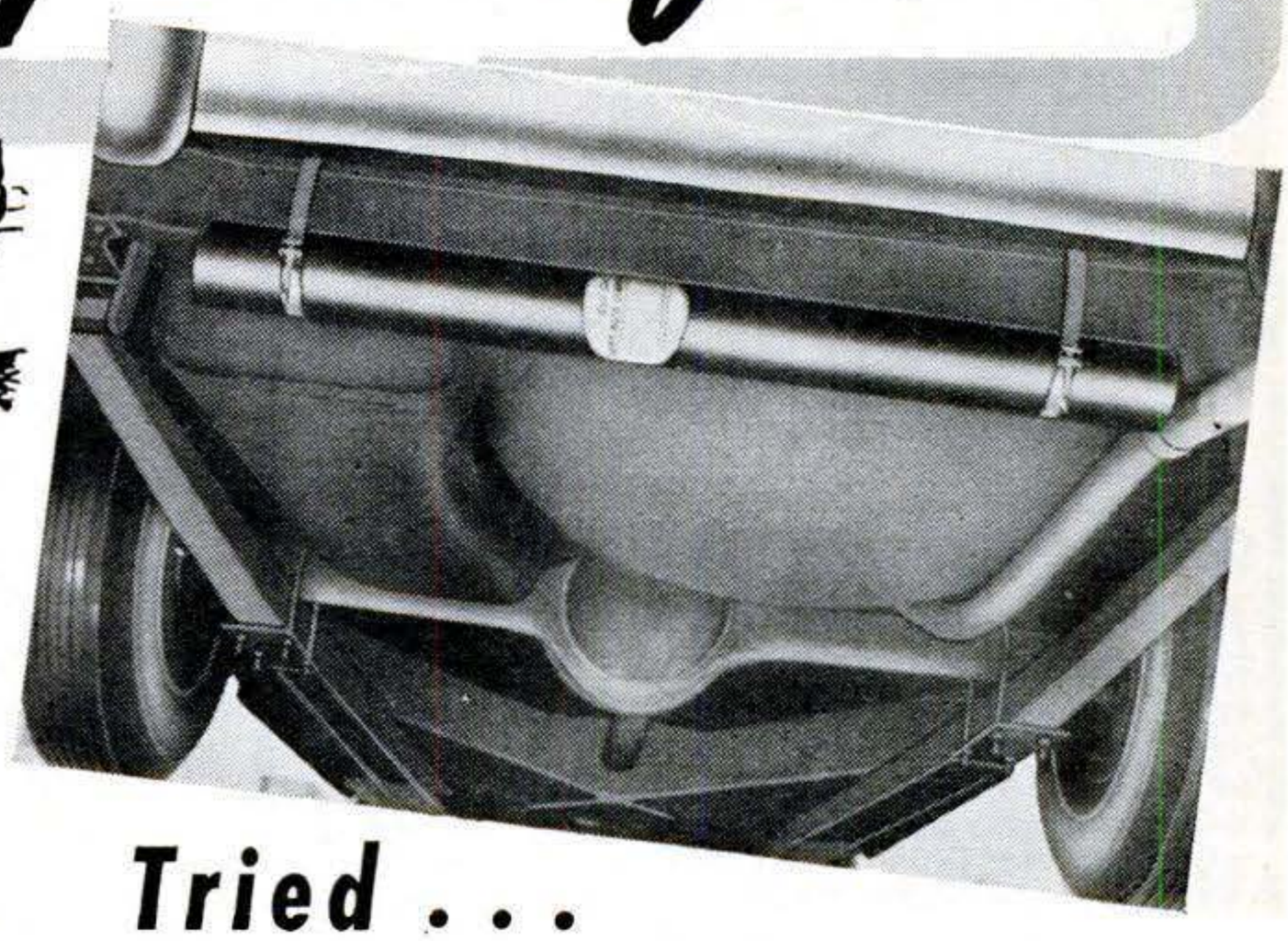
Dr. Ross GYRO-SKID CONTROL

ON YOUR CAR... CAN

Save Your Life!





CONTROLS SIDE SKIDS ON ANY SURFACE . . . UNDER ANY CONDITION!

Skidding is a result of a lateral displacement of weight. Dr. Ross GYRO-SKID CONTROL acts as a counter centrifugal force and maintains equal weight distribution on both rear wheels. This amazing invention of Dr. William Ross is a 3-foot cylinder which is easily attached to the rear cross member of any car by means of two simple clamps. No car is safe without it!

CONTROLS SIDE SKIDS

ADDS TRACTION

INSURES CONTROL ON CURVES

AVOIDS BLOW-OUT INSTABILITY

ACT NOW...
TRY GYRO-SKID CONTROL ON YOUR CAR AT OUR RISK!

Mail the coupon for immediate delivery. Enclose check or money order. We pay complete postage, everywhere.

DANIELS ENGINEERING CO.
BOOK TOWER, DETROIT 26, MICH.

Tried . . . Tested and PROVEN . . .

As reported in every leading automotive publication and newspaper, Dr. Ross GYRO-SKID CONTROL has been tested and approved by traffic and safety departments from coast to coast. It has been proven on the racing cars of such famous drivers as Troy Ruttman, Walt Faulkner and others. Leading engineers like Clay Smith and Bill Stroppe have tested and enthusiastically endorsed this revolutionary safety device. Now, for the first time, you can have this miracle life-saver on your own family car.

Installs Without Tools In Just One Minute. Interchangeable From Car To Car. Lasts A Lifetime.

$39.95 COMPLETE

DANIELS ENGINEERING CO.
BOOK TOWER, DETROIT 26, MICH.

Enclosed find $39.95 in check or money order. Please rush a Dr. Ross Gyro-Skid Control. I understand the full purchase price will be refunded in 10 days if I'm not 100% satisfied.

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Address _____

City _____ State _____

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The NEW Model 50 UTILITY TESTER

FOR REPAIRING ALL ELECTRICAL APPLIANCES-MOTORS

an all-around electrical trouble shooter

- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, etc.
- Will measure the current consumption while the appliance under test is in operation. The appliance or utility may be plugged directly into the front panel receptacle. A special pair of insulated clip-end leads is included for motors, etc.
- Incorporates a sensitive direct-reading resistance range which will accurately measure all resistances commonly used in electrical appliances, motors, etc. This range will enable continuity checks and tests for shorts and opens.
- Will test thermostats, radio tube filaments, bulbs, fuses, fluorescents, condensers, switches, field coils, circuit breakers, lighting systems, etc.

Handsome round cornered molded bakelite case 3⅛" x 5⅞" x 2¼". Complete with all test leads and instructions.

$13.90

SHIPPED ON APPROVAL

No Money With Order — No C.O.D.

Try it for 10 days before you buy. If completely satisfied send $3.90 and pay balance at rate of $2.00 per month for 5 months —No Interest or Carrying Charges Added. If not completely satisfied, return to us, no explanation necessary.

SUPERIOR ELECTRONIC CO., INC.
Dept. D-21, 227 Fulton Street, New York 7, N. Y.
Please rush 1 Model 50. I agree to pay $3.90 within 10 days after receipt and $2.00 per month thereafter.
Name .....
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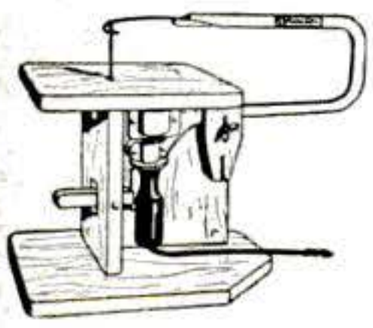
DREMEL Electric COPING SAW

CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS

MAKE YOUR OWN JIG SAW PLANS FREE!

JUST GUIDE IT!

SAFE! AS A HANDSAW



For home, hobby, repair work—no other tool pleases so much for so little cost. Works in any direction—delivers 7,200 strokes per minute smoothly, effortlessly. Saws through ¾" medium-hard wood at a foot-a-minute speed. Touch-of-the-trigger, foolproof action. Only 2 moving parts, never needs oiling. Uses 110-120 v., A.C. Free plans, packed with each saw, for six useful woodworking projects and for making your own jig saw.

WHERE TO BUY. Dremel Tools are sold everywhere. If your dealer cannot supply you, send remittance in full and we will ship postpaid. Or send only $2 and pay postman balance plus postage and fee. Money back if not delighted after 5 days' trial.

DREMEL MFG. CO., Dept. 122-G, RACINE, WIS.

The Great Subway Maze

[Continued from page 63]

paper containers are placed in strategic spots on the platforms, but the passengers' aim is often poor and their instinct for neatness weak. It takes 1,502 porters to clean up the daily mess and to wash off the wall drawings of some of the system's more artistic young patrons.

The cost of this constant tidying-up process is several million dollars a year, but there is a shred of financial return. The city disposes of more than 100 tons of waste paper from the subways every month. In one recent year the total income from this strange by-product of underground transportation was $21,000.

Has Anybody Seen My Snake?

Passengers lose more than their tempers on the subway—forgetful riders have left behind thousands of items of property, ranging from $11,800 in cash (never recovered) to the body of a snake, carefully preserved in a jar. Last year 50,000 items were collected, including 6,500 umbrellas, as well as handbags, wallets and jewelry. In other years the residue has included false teeth, a wooden leg, a bass viol, crutches and guns. As the unclaimed property accumulates, the Board of Transportation auctions it off.

People are sometimes moved to write to the Board and tell its members how to improve subway travel, including proposals for smoking cars (no smoking is allowed underground) and dining cars!

Regular passenger cars, costing $66,000, are 67 feet long and seat 80 people. No one has risked a guess as to the maximum number of standees that can be jammed into a car, but inadvertent attempts to find out are made nearly every day. The Board of Transportation cheerily estimates that at the present time during rush hours there are 165 standees to every 100 passengers seated, a figure that calloused subway regulars are inclined to think low.

More Room—Standing Room

Sitting in a subway car seems to be going out of style, anyway. Cars of a special eight-car, stainless-steel train, built in 1949, seat only 54 passengers, deliberately making more than normal room for standees.

Cars similar to these will undoubtedly be purchased for the forthcoming Second Avenue line and perhaps someday will be run-

[Continued on page 216]

Builder of the sensational **CUNNINGHAM** selects **CHAMPION** spark plugs for America's

TOP SPORTS CAR!

Phil Walters driving one of the Cunningham cars in the Watkins Glen, N. Y. Grand Prix. Walters went on to win, setting new lap and average speed records for this event.

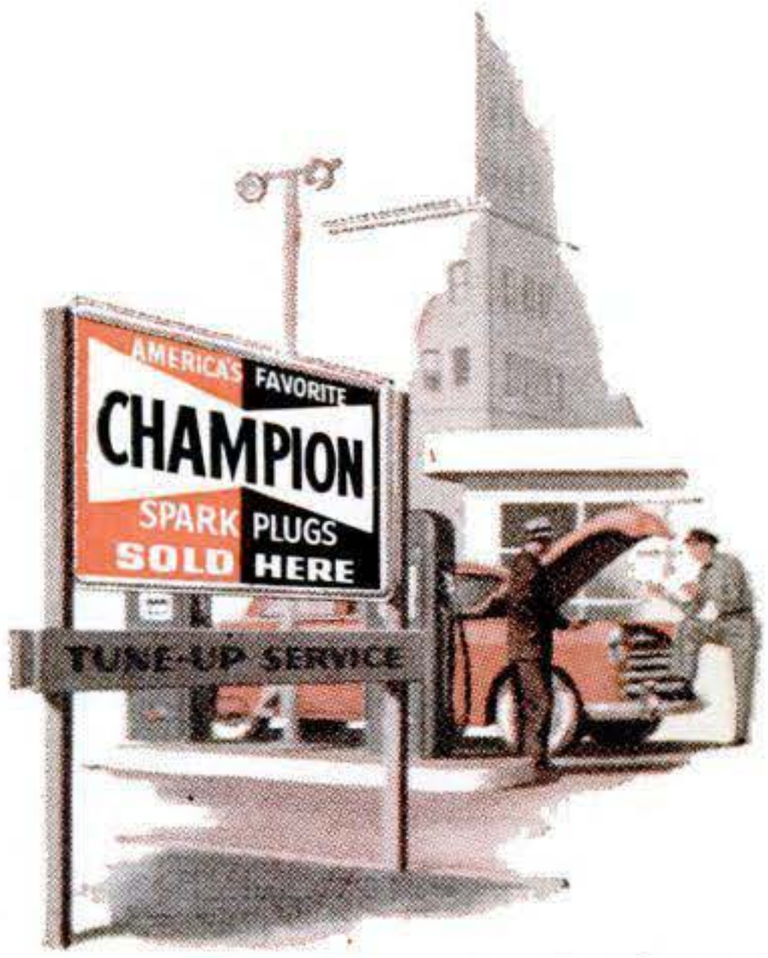
Briggs Cunningham at the Bridge in the Watkins Glen race. These cars driven by Walters, Fitch and Cunningham, placed first, second and fourth, in this Sports Car classic.

BRIGGS S. CUNNINGHAM (shown here with a 300 HP, 150 MPH Cunningham open tourer) has made a great contribution to the re-birth of American road racing for sports cars—competition cars suitable for everyday driving. In his Florida plant, Mr. Cunningham is manufacturing American sports cars to compete successfully with the best that Europe has to offer.

"Sports car racing in the United States and Europe imposes extreme demands on engine performance. While this form of racing has its share of sustained top speed driving, it places a much greater premium on flexibility. Phenomenal cornering at unbanked turns, terrific bursts of speed coming into the straightaways, shifting down through gears for maximum power, control and braking at steep grades and corners, then up through gears again for top overtaking speeds—all call for fantastic engine acceleration and equally severe deceleration. Only the most rugged spark plugs can take this grueling punishment and still deliver competition quality performance.

We've found that Champion Spark Plugs more than live up to their great reputation for long life and dependability under these conditions. We use Champions exclusively in the Cunningham cars."

—BRIGGS S. CUNNINGHAM



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CORBIN CABINET LOCK DIVISION
The American Hardware Corporation
New Britain, Connecticut

The Great Subway Maze

[Continued from page 214]

ning over a belt line from New Jersey to New York and back. Until these additional lines and trains are available, thousands of subway passengers during rush hours will have continued reason to exclaim, as did Tallulah Bankhead in a recent radio skit, "Sir, kindly remove my eye from your elbow!"

Subways May Ease Auto Jams

Anyone who has ridden on a New York subway train during a rush hour, trapped in a strait jacket of perspiring human bodies, can sympathize with the widespread longing among regular passengers for the extra elbow room that more rolling stock and additional routes would afford. But the main reason more subways are needed lies above the heads of the subsurface sufferers. Too many commuters and visitors, inspired by the handsome bridges and vehicular tunnels available, are driving into the city or arriving on out-of-town buses. Add their vehicles to those normally operating in town and you have a daily snarl of street traffic that is threatening to send New Yorkers out of their minds—and, worse yet for local business, out of New York.

No one yet has thought up a workable way to untangle the snarl. Rerouting traffic has caused confusion and raised howls from merchants without taking out the kinks. Now New York and New Jersey planning commissions have begun to wonder if a new subway, linking the two states at the Hudson's banks, might not be the solution.

Overcrowding Isn't New

New York's subways have been a source of wonder and irritation right from their start, on the afternoon of October 27, 1904, when Mayor George B. McClellan (son of the famous Civil War General) ran the first subway train nearly all the way to the end of the nine-mile line.

The lure of the new subway drew so many people that the few station platforms were "packed to suffocation," wrote a *N.Y. Herald* reporter. Another newsman reported in astonishment that "men fought, kicked and shoved to get on!" The crush in the station at the end of the line soon became so great that police reserves had be be called. "Hats were broken and coats torn off."

Variations of that scene have been enacted every day ever since. END

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A gear shift that really works—engineered for outboards only. Salt water proof. Stays in adjustment. Meets Mercury's rigid standards of performance.

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FULL JEWELED POWER—
ball and roller bearings throughout.

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Here it is—tomorrow's outboard today! Drive it and see why the new Mercury Cruiser is bound to be copied. For here is an outboard that gives you *more* performance than others of two to three times its rated horsepower—with up to 30% *less weight!*

The New "Cruiser" is another product of Mercury's CREATIVE ENGINEERS . . . men who steer clear of "dead tradition" . . . who are never satisfied with "*good enough*". Thanks to their progressive spirit Mercury outboards OUTPERFORM ALL OTHER MAKES!

See your Mercury dealer for *one* convincing demonstration and you'll *own* tomorrow's outboard today!

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*For the wood siding on the average 5-room house.

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SCREENING MADE FROM ALCOA
ALCOA
ALCLAD ALUMINUM

This tag means quality. Look for it on screening you buy.

Mechanics Build Racing Planes

[*Continued from page 120*]

In 1946, Howard and Chester were invited to dust off their plans and go to work. As a result, in 1947, at Cleveland, 13 midget planes got to the starting line and leaped into the sky to compete for $25,000 of prize money in the first Goodyear Trophy Race for midget planes. This year at Detroit the midget race will be the big attraction. Some 75 entries will compete for the Continental Motors Trophy plus cash.

Racing Rules Are Strict

Biggest change from old times is the complex of rules that attempt to safeguard modern midget racing. Rigid regulations governing minimum weights, wing loading, wing area, strength factors, visibility, engine tampering are enforced by the Professional Race Pilots Association, the National Aeronautics Association and the Civil Aeronautics Administration. A pilot must wear crash helmet, parachute, safety belt and shoulder harness. Otherwise, he can fly in his underwear! There is a Race Technical Committee to double-check each entry.

Yet air racing remains the most dangerous of all spectator sports—and one of the most thrilling. It takes pilot skill and nerve to hang on while the midget rounds the pylons at 200-plus miles an hour, not much above the level of the grandstand roof.

Prop Wash Is Dangerous

The prop wash from the guy ahead is tricky. All the rules and regulations to the contrary, the wash can take hold and throw you out of control before you have a chance to save yourself. That's what happened to Art Chester who crashed to death before a stunned audience at San Diego in 1948.

Bob Heisel was another victim of prop wash the same year. Chester Black was killed when his racer fell apart as he pulled up too sharply during a race at Cleveland. Paul De Blois banked too sharply in a midget race, raked the ground with a wing tip and died in flames. Safety rules can't do much to prevent accidents like those.

But what of the future? The jet-propelled midget plane, of course. It's on the designing board. One engine is in the works at Continental and will soon be available. Soon the back-yard mechanics will be wrestling with the problem of how much of what it will take to put a 900-pound "midjet" around pylons at 300 m.p.h. END

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HIGH SPEED MORSE TAPER SHANK DRILLS

Reconditioned and sharpened—ready to go! Many drills with extra lengths of flute. Immediate delivery. These drills are priced as low as 25% of your present cost and shipped post paid to you.

Size in in.	Twist Lgth.	Price	Size in in.	Twist Lgth.	Price
37/64	6¼	$1.00	1-11/64	7¾	$3.95
19/32	4¼	1.00	1-3/16	7½	3.95
39/64	6¼	1.06	1-13/64	8½	4.14
21/32	6	1.19	1-7/32	8½	4.14
11/16	4½	1.31	1-15/64	7½	4.51
23/32	5	1.44	1-21/64	5½	5.38
47/64	5	1.57	1-11/32	9½	5.38
¾	5	1.57	1-27/64	6	9.95
49/64	4½	1.64	1-15/32	8	6.13
51/64	5½	1.85	1-17/32	7	7.16
13/16	22	8.00	1-9/16	10½	7.50
27/32	5½	1.91	1⅝	10½	8.50
55/64	5½	2.02	1-11/16	12	9.13
7/8	4¼	2.02	1¾	5	6.00
57/64	5¼	2.12	1⅞	9	11.56
15/16	5¼	2.20	1-15/16	11	12.95
15/16	9¾	4.00	1-31/32	10	13.95
61/64	4⅛	2.42	2⅛	10	15.00
31/32	4¾	2.42	2-7/32	11	16.50
63/64	5	2.50	2¼	10¾	17.50
1-1/32	6	2.76	2-9/32	7¼	16.00
1-3/64	8	2.82	2-5/16	7	16.25
1-1/16	7¼	2.82	2⅜	9	18.00
1-5/64	7¾	3.33	2-7/16	11	21.50
1-3/32	6	3.33	2-15/32	13	23.50
17/64	9	4.00	2½	11	25.00
1-7/64	18½	8.50	2-13/16	14½	27.50
1⅛	8½	4.00	3	10	30.00
1-5/32	6½	3.76	4	9	34.50

Large quantities available in every size. 5% DISCOUNT ON PURCHASES OF $50 OR MORE. 10% DISCOUNT ON PURCHASES OF $100 OR MORE.

HIGH SPEED WOODRUFF KEY SEAT CUTTER

SET 4C 5 different size cutters. Can be used as mounted milling cutter or circular saw. All with ⅜" and ½" shanks, widths up to ¼", dia. up to 1". New and used. Ppd. Priced at only.... $3.95

6 Slitting Saws with Mandrel

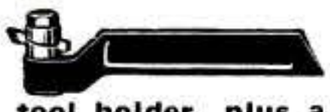
SET 34C 6 Different Size High Speed Slitting Saws, 2¾" dia. x 1" arbor. Thickness from .040 to .071. Cuts wood, aluminum, brass, steel, etc. PLUS SPECIAL MANDREL which enables use of saws in ¼" or ½" elec. drill. $25 Value. Ppd. Only... $4.95

7 selected, sharp H. S. Slitting Saws as above to use on your own mandrel or milling machine. New and used. Ppd. A bargain at..... $4.95

New Carbide Tip Masonry Drills

Carbide tip goes through any masonry. Set of 5 bits containing one 7/32"; three ¼" and one 5/16", all five, $10 Value, only $2.49

NEW 360° SWIVEL TYPE TOOL HOLDER AND BORING BAR



Here is a tool that will do the work of a left, right and straight tool holder, plus a boring bar, all for a fraction of its original cost. Post paid to you.

TOOL A takes a 5/16" sq. bit or 5/16" dia. boring tool. Shank size 9/16"x1"x4¾". PPD. Only..... $3.29

TOOL B takes a ⅜" sq. bit or ⅜" dia. boring tool. Shank size ⅝"x 1-3/16"x5¾". PPD. Only..... $3.95

TOOL C. Cut-off blade holder for 3/32"x⅜" blade. Shank size ½"x1"x4½" (can be changed to fit other size cut-off blades). PPD. Only..... $2.25

SET 41C LARGE H. S. STRAIGHT SHANK DRILLS: 5 different size high speed Drills from ¾" to 1¼". Twist length up to 7". Sharp new and used surplus. Specify desired shank dia.: ½", ⅝", ¾", 1", etc. PPD. Only $14.50

AIR TANK—REGULATOR—MASK A4 Tank—5" x 8", 104 cu. in., 500 psi... $1.50

D2 Tank—6½"x24", 500 cu. in., 500 psi..... $3.95

Demand Type Regulator $1.00; A14 Breathing Mask, $1.60.

Make your own diving apparatus. Mask fits regulator—regulator fits either of above tanks.

Bargain Tool & Shop Mixes!—Ppd.

NEW ROTARY FILE MIX: 7 different size H. S. files, ¼" shanks. New cost as high as $2.00 ea. Only..... $4.49

GRINDING WHEEL MIX: 30 grinding wheels with ¼" arbors, up to 3" in dia., plus mandrel, only..... $3.29

SURPRISE MIX: Over 50 pcs. for your ¼" elec. drill including rotary files, drills, bits, reamers, grinding wheels and arbors for our customers who like pleasant surprises. Your money back if you aren't satisfied..... $2.98

¼" to ½" H. S. DRILL MIX WITH ¼" SHANKS: 10 different size new and used bits, only..... $4.95

100 MOUNTED POINTS: ⅛" and 3/32" shanks: assorted shapes and sizes..... $8.98

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DOUBLE-END END MILL MIX; 4 right hand twist H. S. ⅜" straight shank end mills, up to ⅜" dia. New and used..... $3.98

Money Back Guarantee—All Mdse. Mixture of New and Recond'tioned Unless Specified New. ALL ITEMS (EXCEPT THOSE SPECIFIED POST PAID) WILL BE SHIPPED F. O. B. TULSA—OR, ADD 10% AND WE WILL SHIP YOUR MDSE. PPD.

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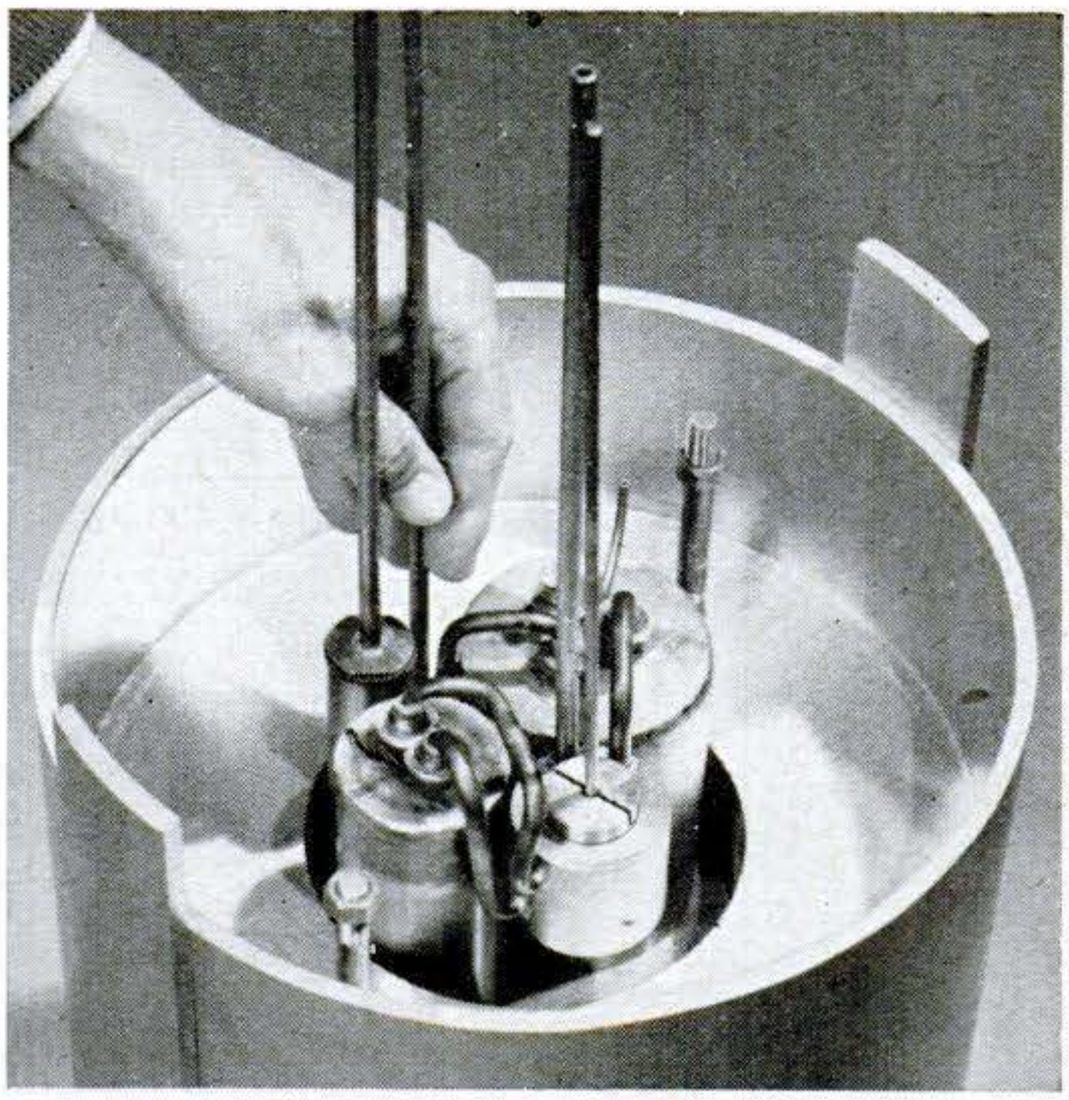

By simply plugging in a portable gadget that looks like a fireless cooker, a doctor will be able to get radioactive iodine whenever he wants it. Formerly, such isotopes, valuable in medicine and research, could be made only in atomic piles.

The "isotope generator" (shown above) yields iodine 132, so short-lived (it has a half life of less than 2½ hours) that it could never be shipped to hospitals from distant reactors. As a substitute, doctors used iodine 131, a longer-lived but less desirable variety. Now the generator, developed at Brookhaven, will offer the highly perishable iodine 132 on tap right at a patient's bedside.

The generator contains tellurium 132, a relatively long-lived isotope that is continuously changing into iodine 132 during and after delivery to a hospital. A built-in electric heater, plugged in by the user, warms the iodine 132 that has formed and drives it out through a delivery tube.

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Radioiodine is especially useful in studying the thyroid gland. The gland picks up iodine from the blood stream, and knowing its rate of absorption permits detecting its disorders, including thyroid cancer. Years ago, surgeons had to operate to obtain a slice of thyroid tissue for chemical analysis. Today they merely administer radioactive iodine and train a Geiger counter on the patient's Adam's apple.

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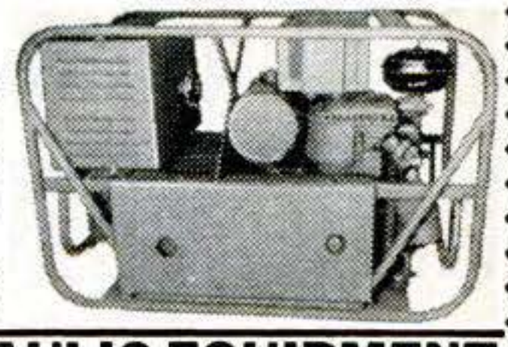
IMMEDIATE DELIVERY. LARGE STOCK. MANY SIZES FROM 350 WATTS TO 25 KVA



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CENTRIFUGAL PUMP

200 GALLONS PER MINUTE

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This General Motors-Allison Centrifugal Pump—designed for use on U.S. Air Force Mustang Fighters, now converted for commercial, home, and industrial high volume pumping applications. Inlet, 2½" standard pipe thread, twin outlets with 1¼" pipe thread, ball bearing supported ¾" shaft. Easy, fast simple priming. Rotation, counterclockwise facing shaft. Shipping wt. 35 lbs. Gov't acq. cost $145.00. F.O.B. Chicago. **NOW ONLY**..... **39.50**

HYDRAULIC SPEED REDUCER

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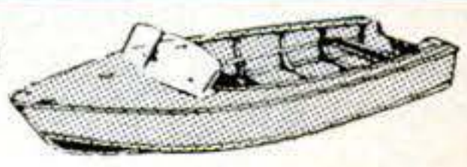

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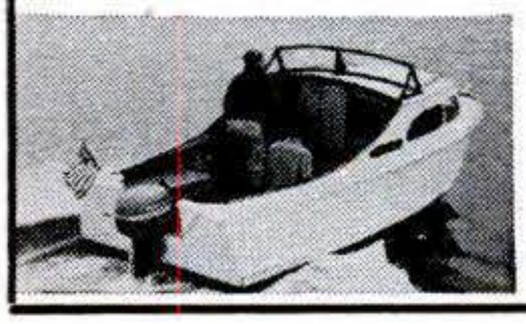

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Ground Radar Guides Night Photo Planes

By teaming up a repeating photoflash gun with a new kind of radar that keeps its finger on a plane in flight, the Air Force has worked out a precise scheme for photo-mapping enemy front lines at night.

The radar rides in a truck trailer—called a TADP, for Tactical Air Direction Post—that can be hauled right up to the front. Its beam "locks" onto the photo plane and traces its flight with a pointer that moves across a map of the area the plane is flying over. The ground controller then guides the pilot by voice radio and tells him when to start shooting pictures. The pilot doesn't need to see the ground or even know where he is.

AIRMAN LOADS FLASH CARTRIDGES into 50-barrel ejector in bomb bay of RB-26. They're packed with small, electrically fired ejection charge and 5¼ ounces of flash powder.

The Light of 50,000,000 Candles

He just flips a switch that starts a gun in the belly of his plane firing out flash cartridges at intervals of 2½ seconds. When each one is about 400 feet below and 900 feet behind the plane, it goes off with a 50,000,000-candlepower flash.

Half a second before each flash the camera shutter opens, and half a second after the flash it closes. The picture thus is snapped with an open shutter. But there's no blur: a motor hooked to the film magazine keeps the film moving across the back of the camera just enough to make up for the plane's forward speed.

Tried on Carolina Maneuvers

In the first tryout of this new night photo-mapping technique, at recent Army-Air Force maneuvers in North Carolina, three two-engine RB-26s of the 112th Tactical Reconnaissance Squadron mapped an area of four square miles in two hours' flying, despite occasional "enemy" jamming of their radios. Each plane, directed by radar 12 miles away, flew three passes over the area at 2,500 feet and 250 miles an hour.

The mission was completed after midnight. Soon after dawn 350 feet of film had been developed, 936 prints made, 104 photos fitted and pasted into a mosaic of the area, and the map delivered to Army ground commanders. END

Paper Made of Sugar Cane

Bagasse, the fibrous material left after juice is extracted from sugar cane, may become an important new material for paper-making. The proposed use would augment the supply of newsprint, a critical defense material.

Employing a new method, the U.S. Forest Products Laboratory at Madison, Wis., has successfully made bagasse paper comparable in quality to wood-pulp newsprint. The process, developed by a New York firm, is said to enable the product to compete with wood-pulp newsprint in price. Plans call for a $15,000,000 paper mill at Clewiston, Fla., to use bagasse from a large existing cane-sugar mill.

Currently, bagasse is used in making fiberboard for structural and insulating purposes.

B-36 Eats Up Aluminum

More than 50 tons of aluminum are used in just one B-36 bomber.

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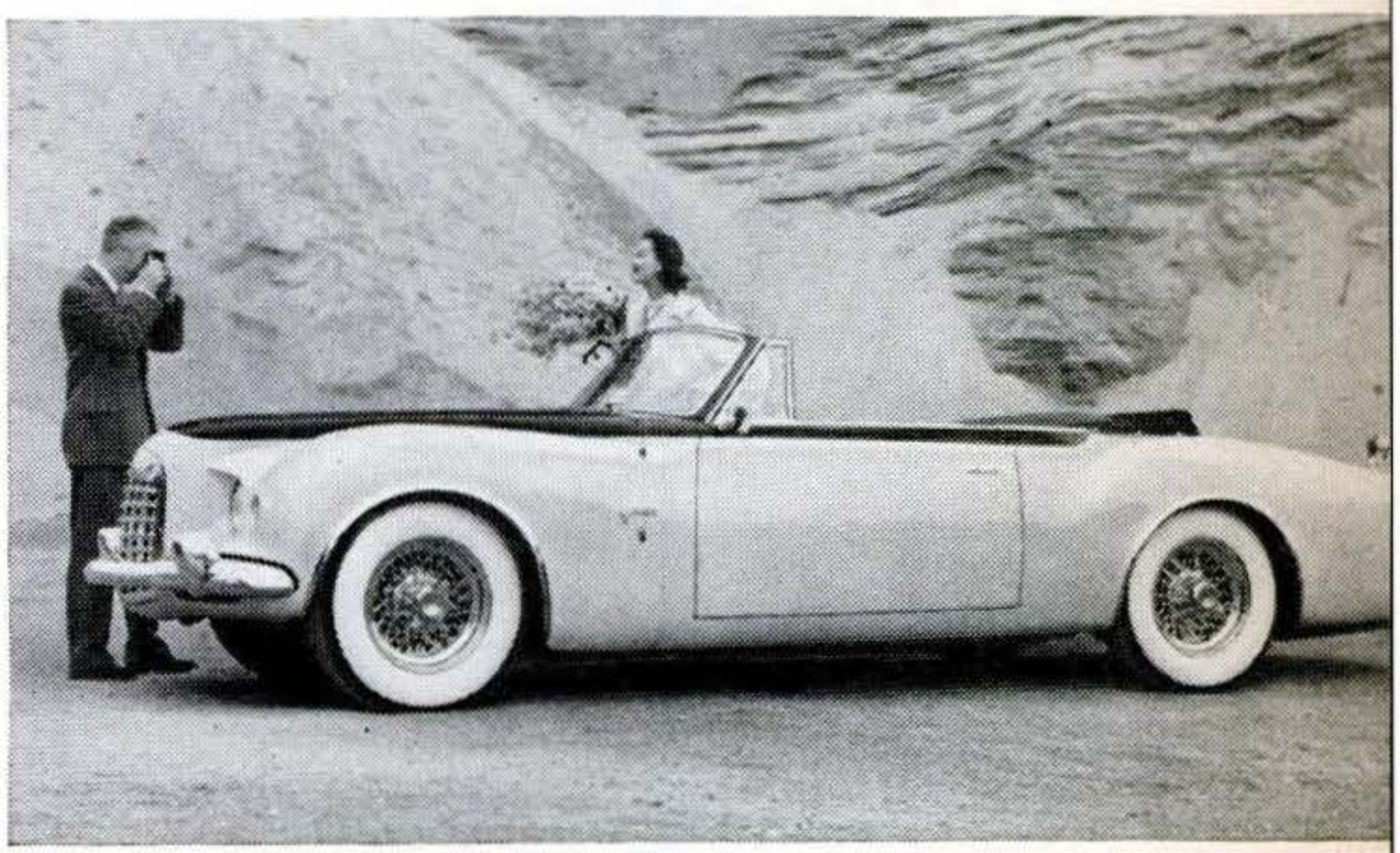

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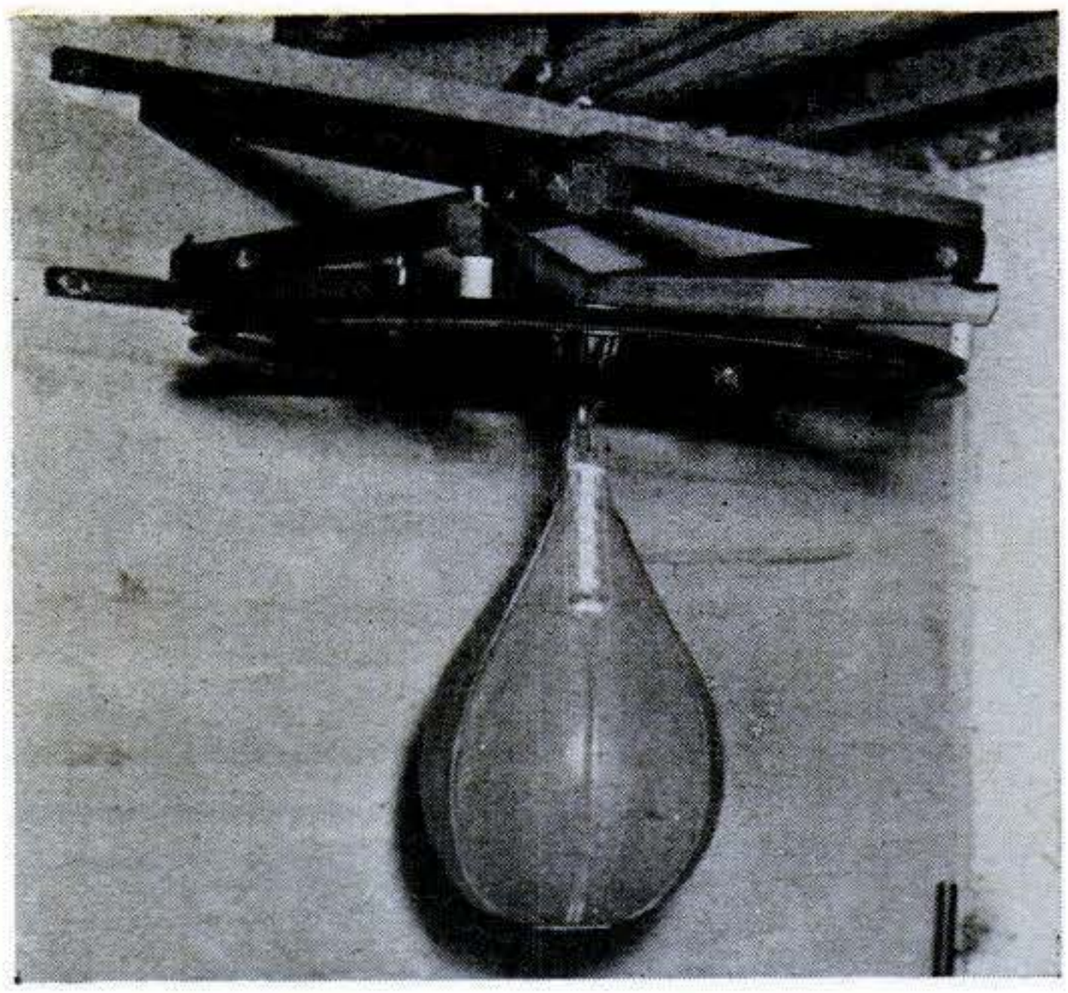
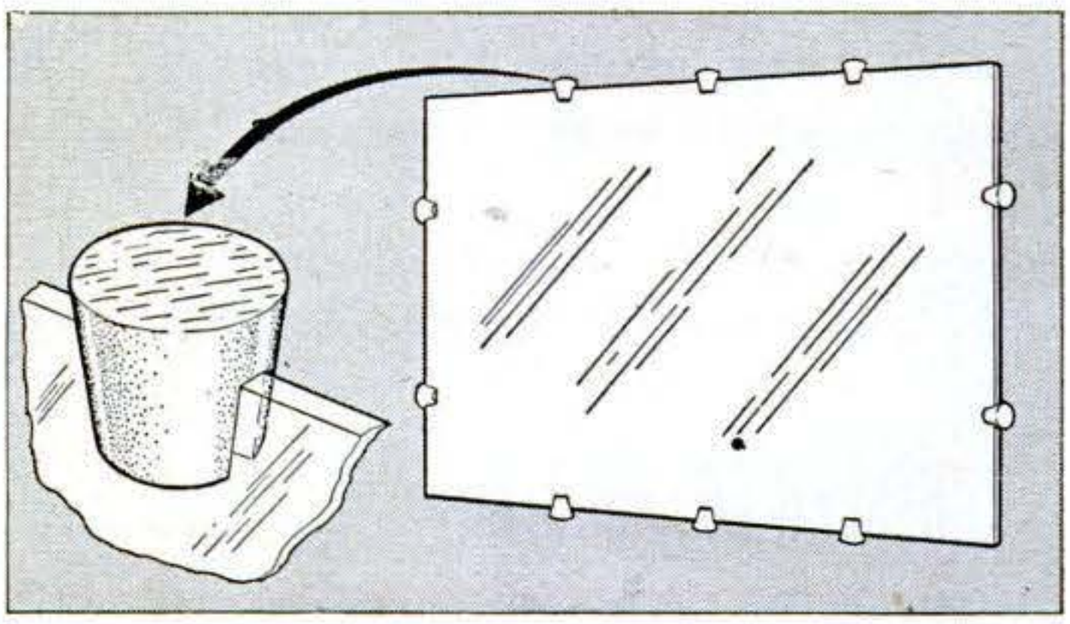


Punching Bag Soft-Pedaled

When Junior starts slugging it out with an imaginary Dempsey or Louis, a punching bag mounted on the cellar joists can make an unholy racket upstairs. You can tone down your basement boxer without spoiling his fun by mounting the bag on a concrete wall. Drill the concrete with a star drill and use expansion bolts to fasten the frame to the wall.—*Grover Brinkman, Okawville, Ill.*



Corks Protect Glass Edges

Large sheets of glass or unframed mirrors often get damaged at the edges when stored on the floor leaning against a wall. Corks slotted with a sharp knife and placed at intervals around the glass will protect the edges.—*George Kapitan, The Bronx, N. Y.*

Plastic Ground Glass Is Unbreakable

You can make a ground glass for your camera from a sheet of 1/16″ clear plastic. Rub one side with a damp cloth and a little scouring powder until you have a light but uniform satin finish. Not only will you have an unbreakable focusing surface, but I feel it produces a brighter image.—*Arthur Trauffer, McClelland, Iowa.*

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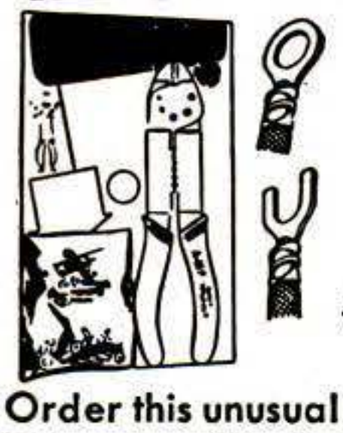

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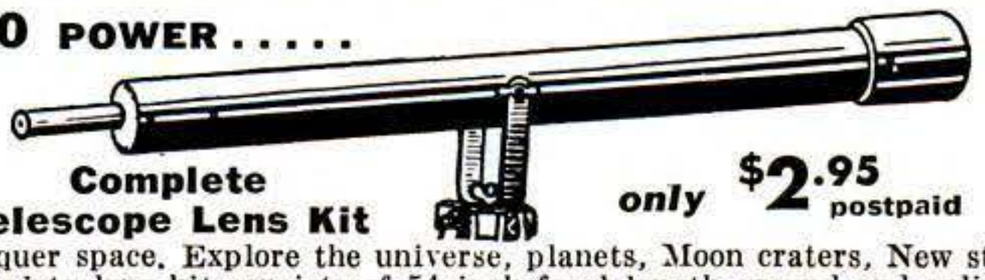

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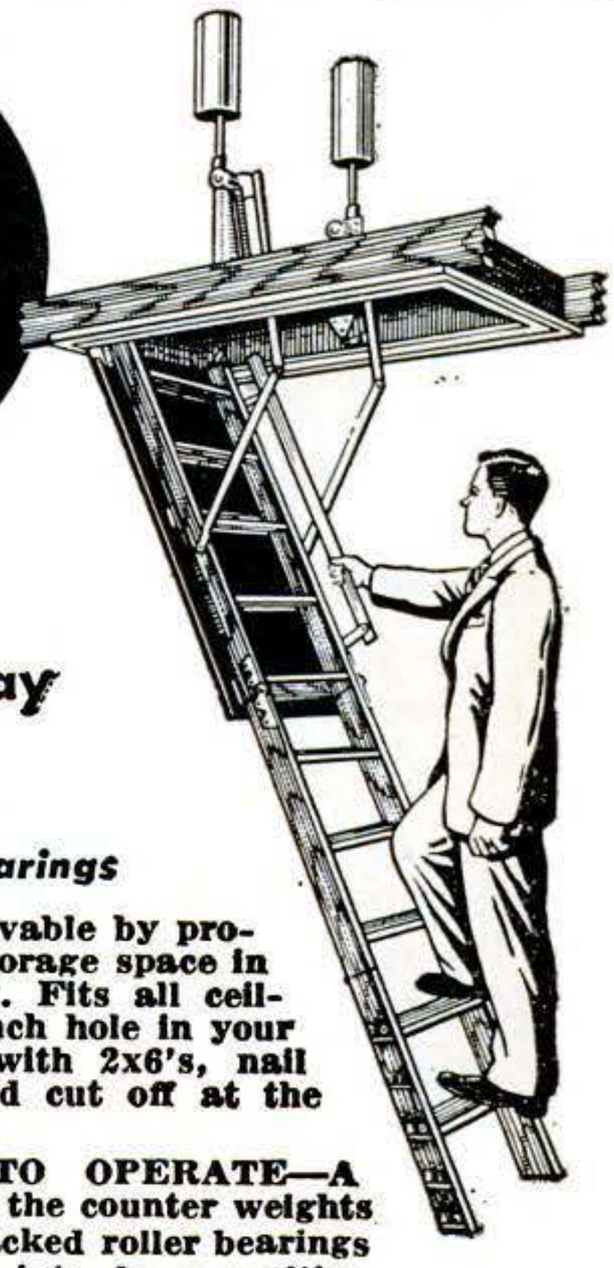

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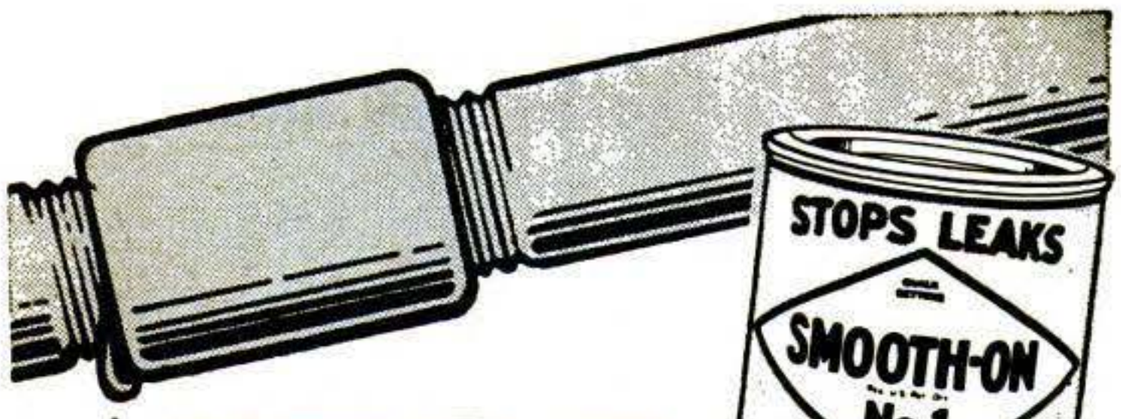

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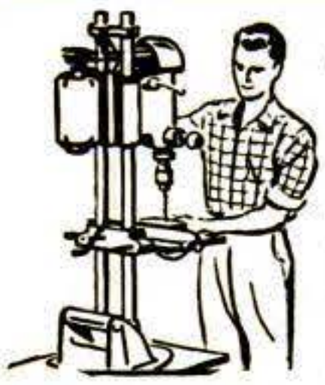

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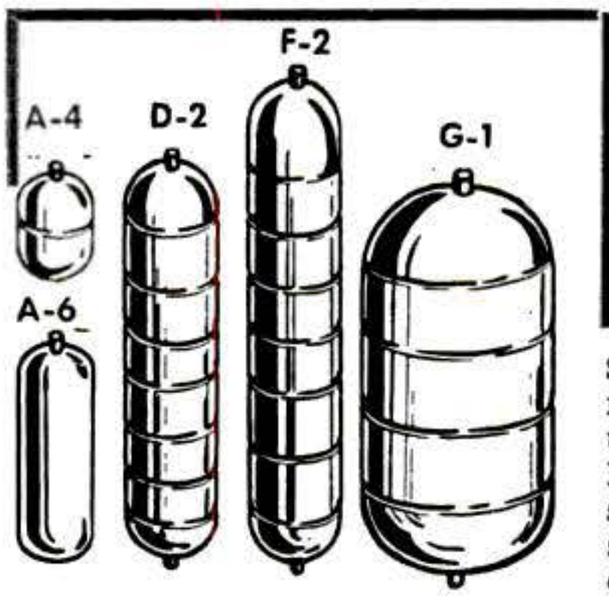

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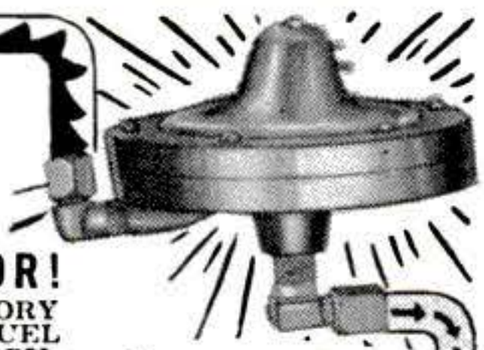

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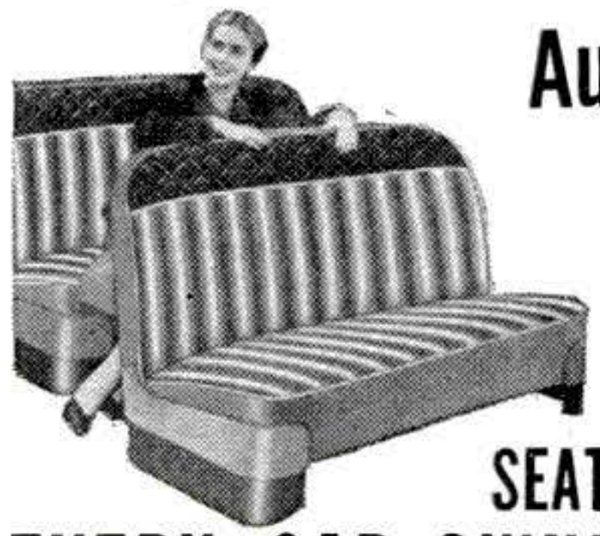

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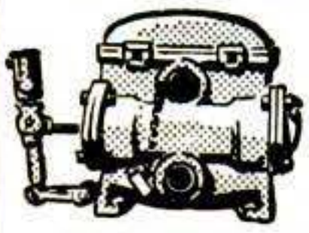

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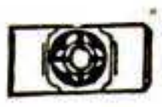

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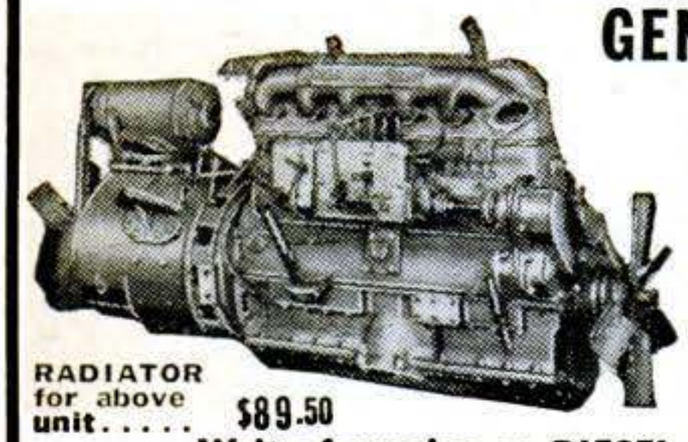

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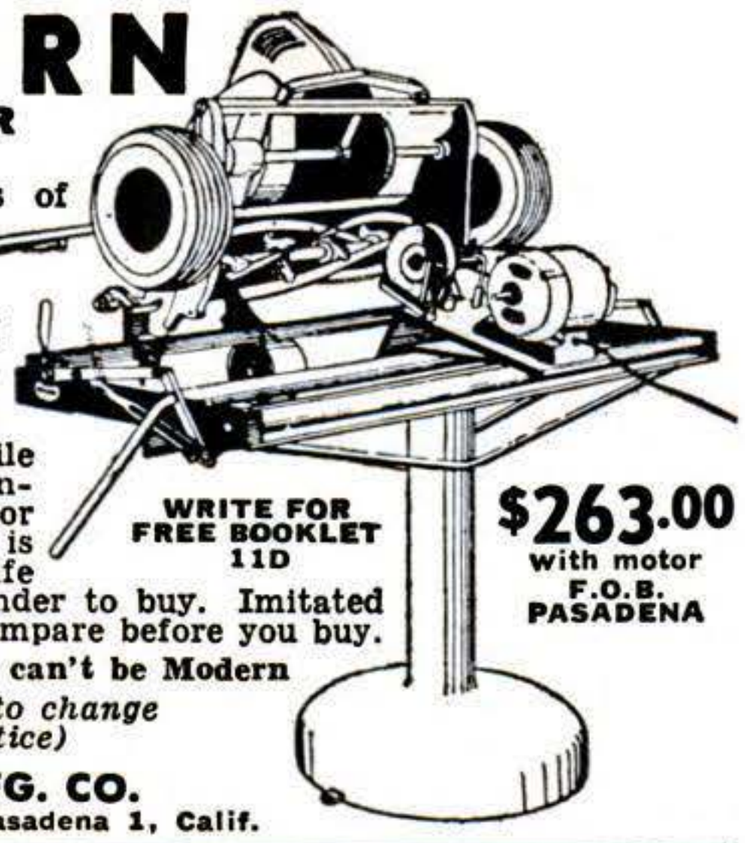

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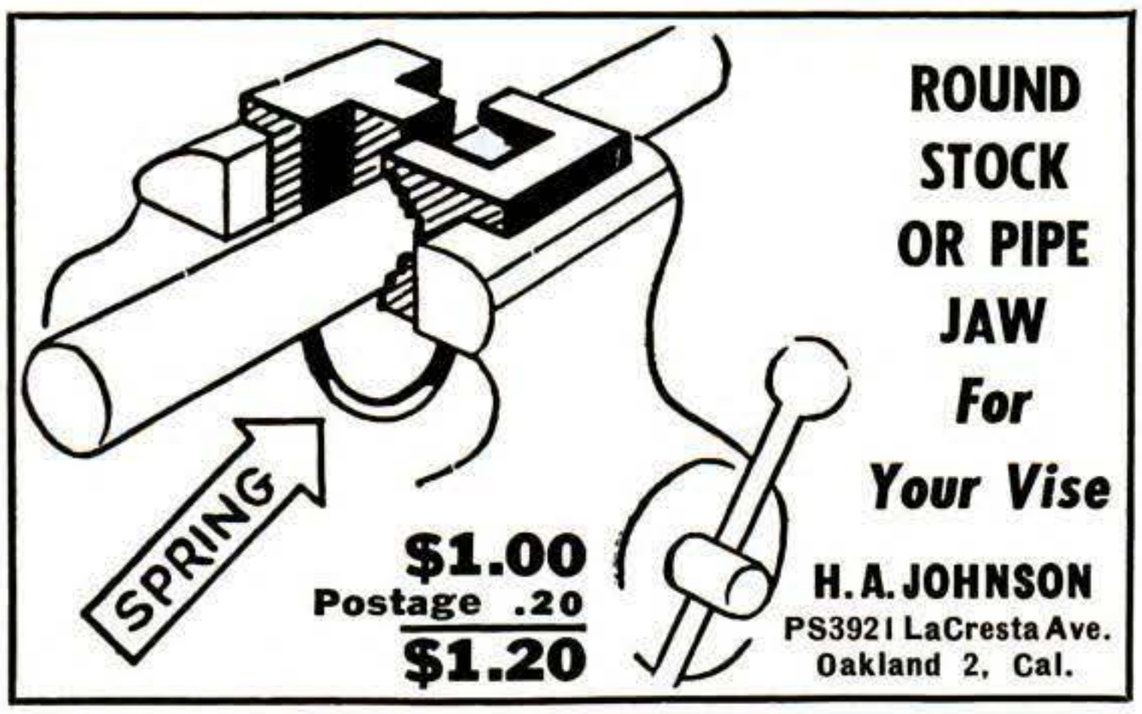

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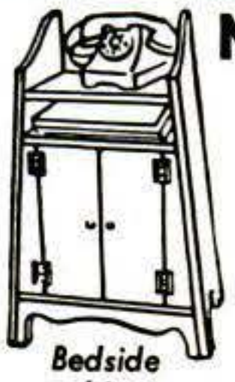

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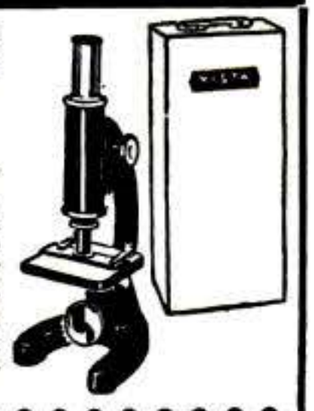

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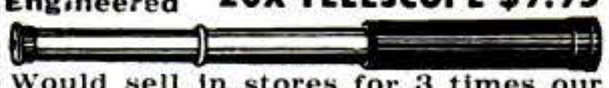

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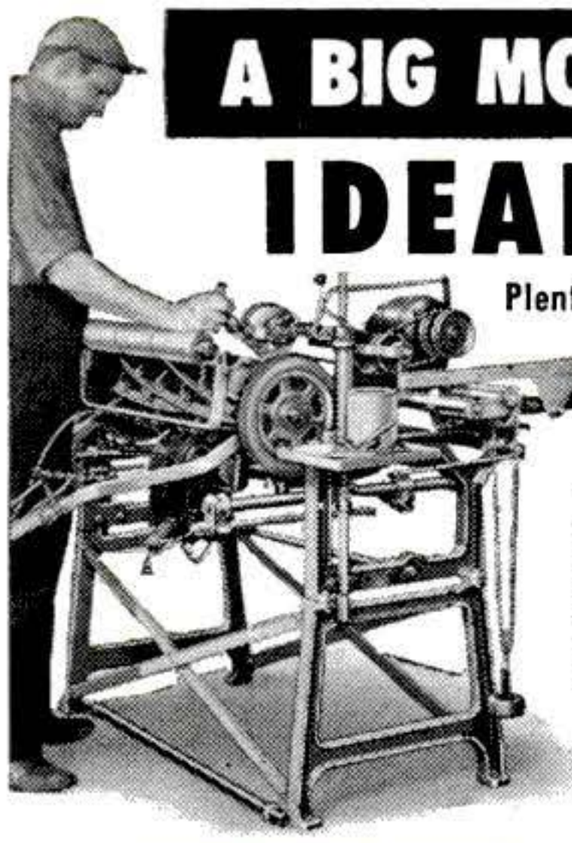

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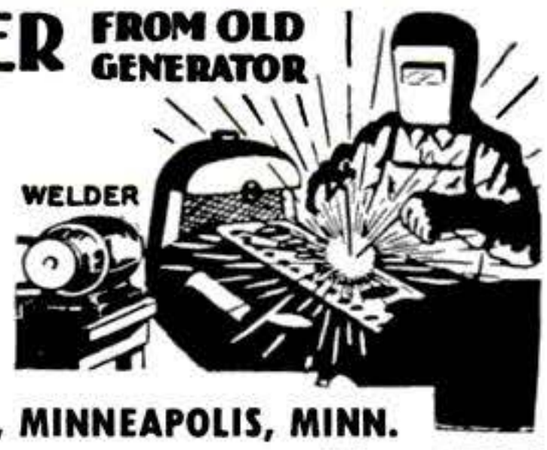

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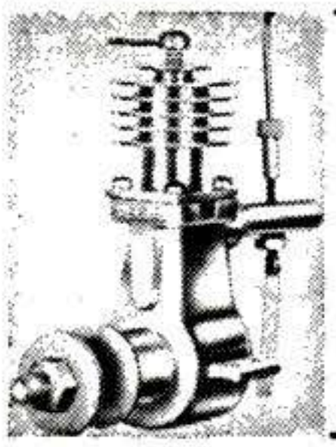

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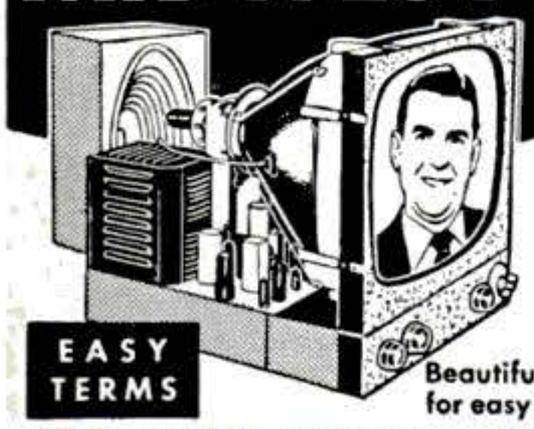

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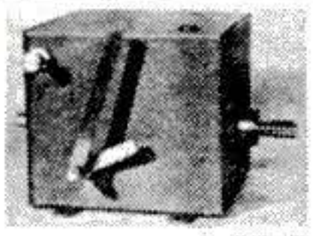

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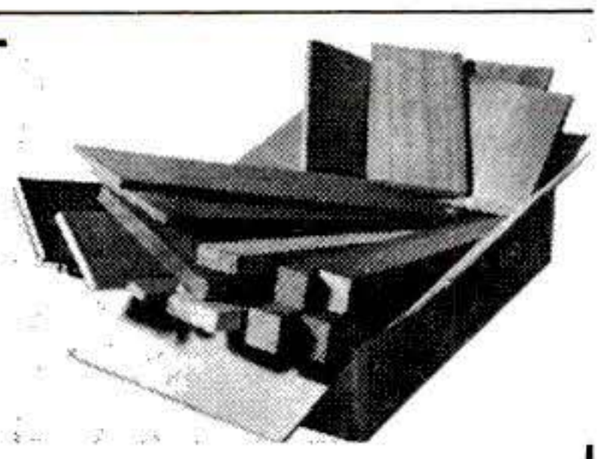

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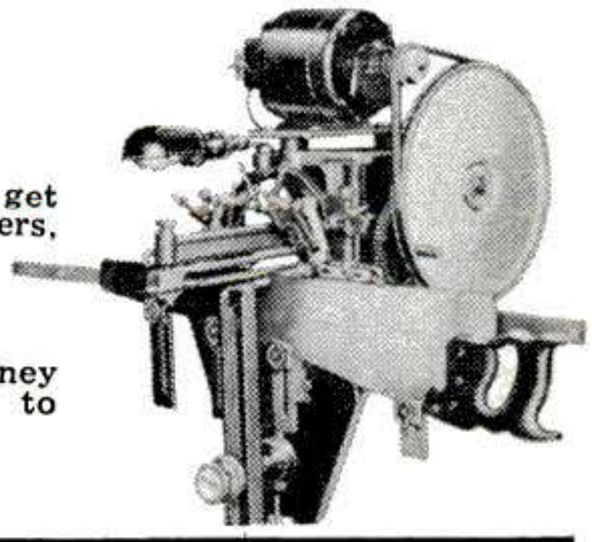

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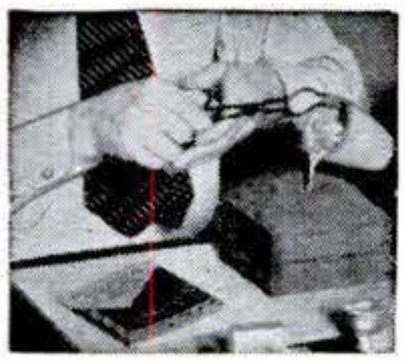

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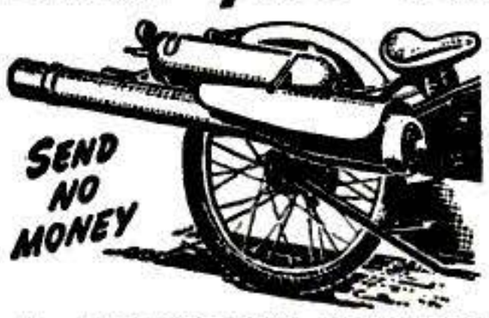

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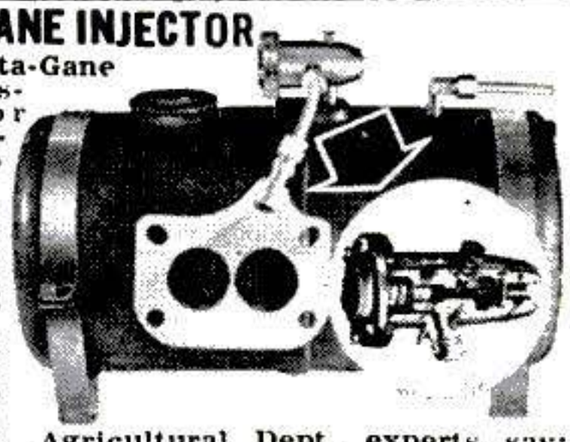

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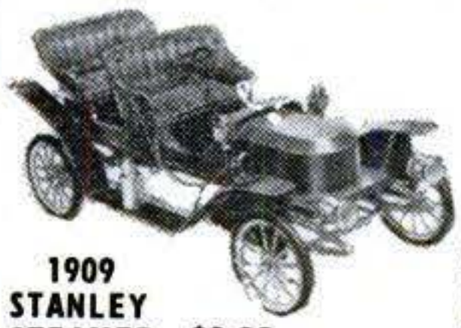
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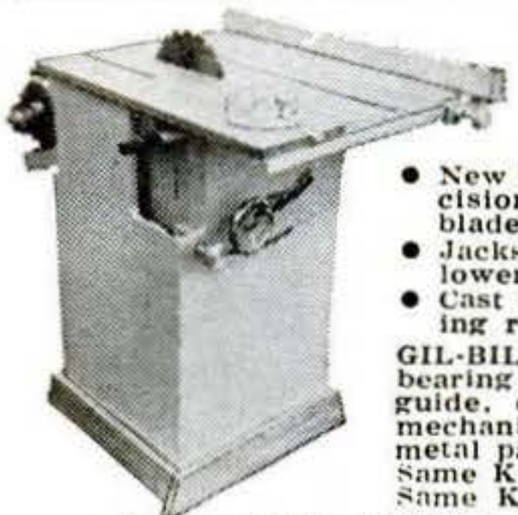

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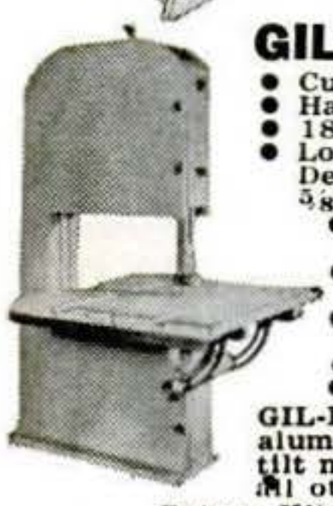

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new, easy way to.. STRIPE with PAINT

Do Perfect Paint Striping at Home with New Kind of

PAINT STRIPING TOOL

This Master Painters' **Striping Tool** makes it easy to do expert striping on furniture, bikes, model planes, autos, signs, toys, linoleum, wall board, etc. Makes plain, painted walls look like tile. Paint straight lines . . . curved . . . circular or evenly spaced parallel lines the same way a professional painter does. Simply fill Tubular-Glass Paint Fountain with any color paint and wheel tip feeds paint evenly. Tips interchangeable—jaws split apart for easy cleaning. Tool complete with tips for 1-16 in. stripe only $1.00 postpaid. Other complete tools with 1-64, 1-32, 3-64, 5-64, 3-32, 1-8 inch tips, $1.50 ea. Extra tips — 75c each. **COMPLETE KIT** with tool and 7 tips, $5.00. Here's the handiest tool in your whole painter's kit. C.O.D.'s post. coll.

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packed in attractive display cartons of 1 doz. Fast, profitable seller. Write for illus. circular, discounts.

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ATTENTION Home Craftsmen and Hobbyists

Just the tool you've been waiting for! New PAINT STRIPING tool gives "professional" results every time, yet simple and easy to use as a fountain pen. Adjustable guide keeps lines straight as an arrow. Just as easy to make curves or free hand designs. Adds new beauty and finished look to everything you paint. Send dollar today.

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The manufacturers of the products you buy have been trying to outdo each other for years to bring you new conveniences, new ideas . . . new improvements on the old . . . all of which have given us more of the good things of life than any other country in the world!

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MODEL W800 2" bore, 1¾" stroke, 2 to 2.8 c.f.m. up to 150 lbs. pressure. Operates with ¼ or ⅓ HP motor..... **$20.50** Shipping wt. 16 lbs.

MODEL W200 2½"x2". 2.55 to 4.80 c.f.m. up to 150 lb. pressure. Operates with ⅓-½-¾ HP motor. Special Price.. **$27.95** Wt. 24 lbs.

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3" A-belt pulley. Centrifugal action for heavy loads. ⅝" bore. $22.50 list. Special Price..... **$9.95**

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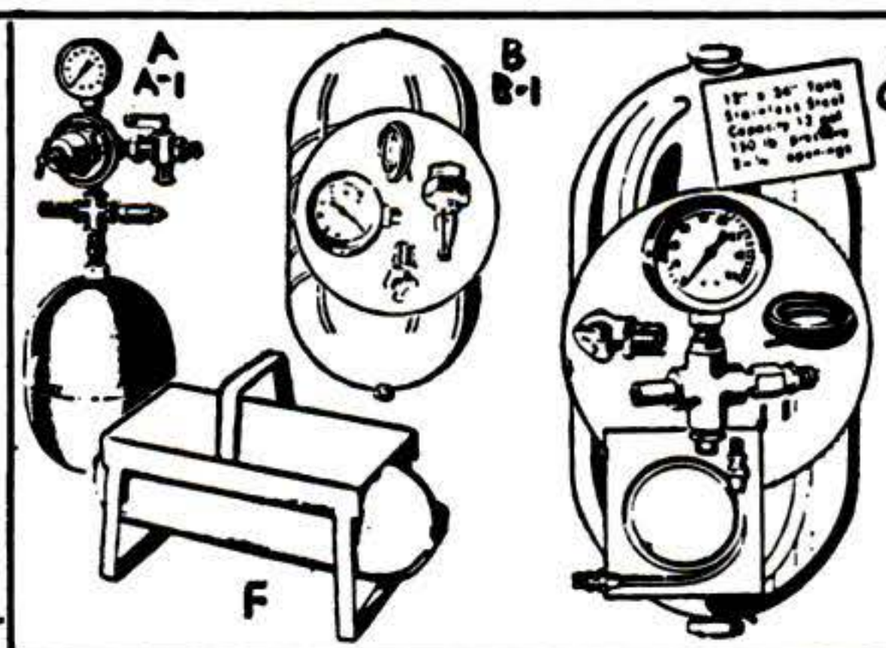
Kidde ½" regulator and gauge. $22 Value.....$12.50

Prices F.O.B. Chicago. Money back guarantee. Send check or money order today. Prompt shipment. **Write for Free Catalog.**



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Models A, B, and C are rated at 500 lbs. pressure per sq. inch. F, and F-1 150 lbs. ¼ in. standard pipe thread openings on ends as shown.

A 8x5¼, wt. 2 lbs.....**1.50**

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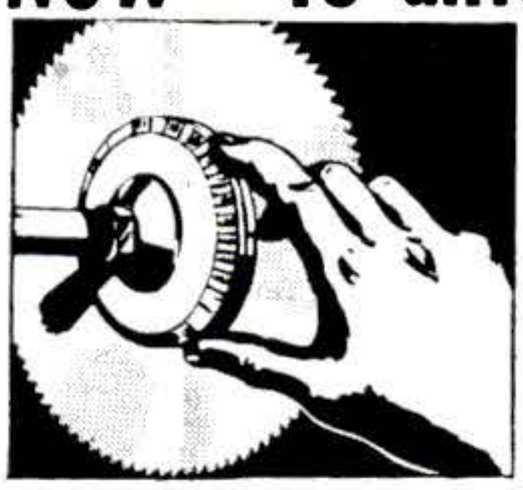

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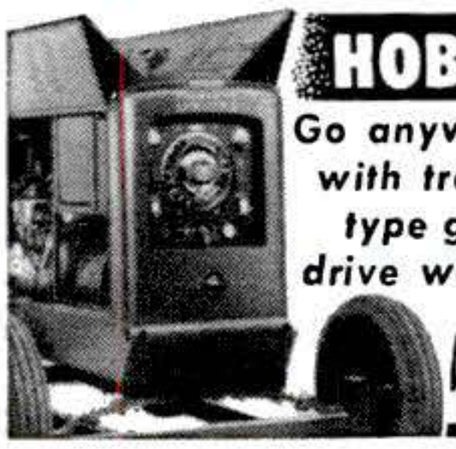

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10" to 26" in depth—they can even take the place of a wall; save as much as 5 feet in total house length. Wide choice of woods—unfinished, or with prime coat, paint, stain or furniture finish. Inner walls and backs are insulating, sound-deadening, mildew-proof. Write for free fully illustrated literature. Dept., 36A—NOVA SALES CO., Trenton 3, N. J.

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Sturdily Made—Hundreds of satisfied customers. Purchased and used by U.S. Dept. of Agriculture, U.S. Dept. of Forestry, U.S. Navy and many foreign countries. Fully Guaranteed. LOW FACTORY PRICE, $385.00; less Motor F.O.B. Factory. Price includes drill, bailer and 100′ cable, 200 ft. of additional length available at extra cost.

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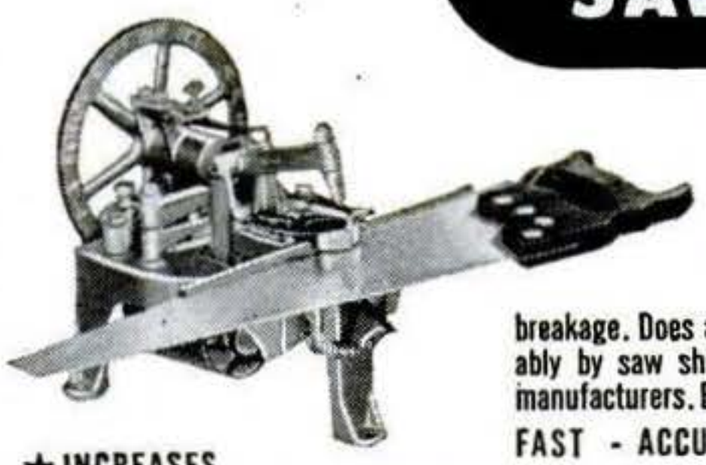

Sets 400 teeth per minute on hand or band saws 4 to 16 point. Hammer and anvil action sets teeth accurately and uniformly . . . No tooth breakage. Does a perfect job. Used profitably by saw shops everywhere and saw manufacturers. Every machine guaranteed!

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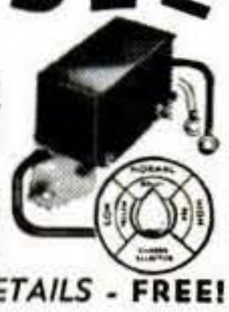
SELECT-A-CHARGE REGULATOR

AN INVENTION AS GREAT AS THE SELF STARTER!



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AC or DC 110 Volts

"The Little Marvel" All-Metal welder

5-year written guarantee. Welds 1/8" thick metal or money back. Repairs tanks, tools, fenders, machine parts, etc. Comes complete with everything—rods, unit, eye shield, and directions. We also make a welder for 16 to 22 gauge metal . . . $3.95 complete. Transformer welder $18.95. On C.O.D., postage extra.

$6.45 Complete

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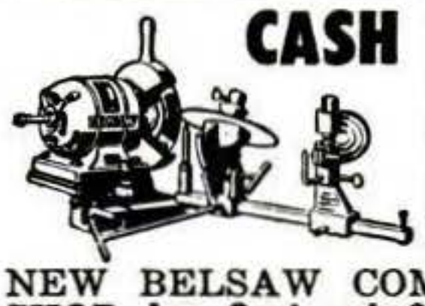

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YOU CAN MAKE UP TO $40 a DAY sharpening and setting circular saws for factories, builders, lumber yards—with NEW BELSAW COMPLETE CIRCULAR SAW SHOP. **Low Cost, only $15 down,** sharpens 4 to 5 saws an hour. *No experience needed!* Instructions Furnished. Send Postcard Today for FREE BOOK. ▶

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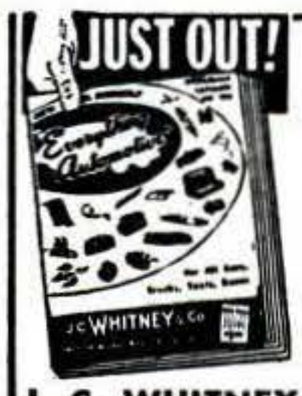

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3-WHEEL KIT NO. T-800

America's Finest Power Mowers completely assembled in 3 and 4 wheel models. Belt or direct drive. 18" and 20" sizes. Nationally known make engine. Latest improved features, sturdy construction and money back guarantee fully described in color folder. Write Today.

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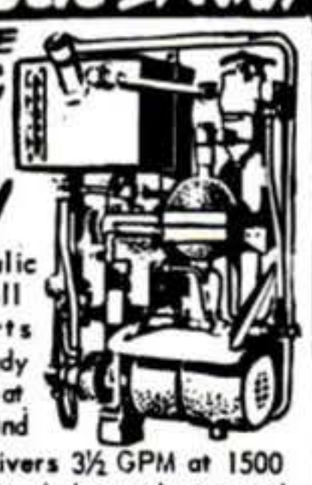
HYDRAULIC Special

COMPLETE HYDRAULIC POWER UNIT!!



Complete hydraulic pumping unit. All necessary parts assembled & ready to work at a great saving in time and cost to you. Delivers 3½ GPM at 1500 PSI at 1800 RPM. (other volumes and pressures can be attained by simple adaptations) Unit consists of a gear pump driven by a 2¼HP, DC motor (4000 rpm max.), relief valve, pressure unloading switch, filter, accumulator, reservoir with sight gauge & complete plumbing. Mounted on 19"x 25" aluminum panel. Complete with 24V-DC motor (Other motors of any current can be adapted) **49.95**

HYDRAULIC CYLINDER SPECIAL

Gives 20,000 lb. thrust (push-pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lb. thrust with 3000 lb. line pressure. Can ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" bore, 1½" dia. piston shaft, 18" stroke, length: 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road, farm & shop machinery, presses etc. Cost gov't $390.00 . . . . . **29.95**

No. 3 DOUBLE ACTION CYLINDER– Bore is 1" - Shaft is 1/2". Has a stroke of 2½" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8½". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 1100 lbs. **5.75**

We carry the World's largest supply of Special Hydraulic Equipment featuring over 20,000 cylinders in 61 sizes and types. Can also supply all accessories such as Pumps, Valves, Tanks, Hoses and Fittings. Write for information.

BENDIX HYDRAULIC PUMP AND MOTOR 19.50

Has 3½ GPM capacity at 600 PSI. Motor is 1½ HP, 24V, DC. Operates on either 12 or 32V, DC current. Has built-in relief valve adj. to 1500 PSI. This unit ideal for bait tanks, hyd. lifts, portable loaders etc. Cost govt. approximately $350.00.

VICKERS HYDRAULIC VARIABLE DISPLACEMENT PUMP GENERATOR

May be used as an elec. motor driven type pressure generator in an hyd. system where a varying volume is desired with a non-pulsating flow. Will give max. volume at pressure settings between 600 & 900 PSI by simple adjustment screw. Pump housing serves as reservoir for system. Has built in compressed air supercharger to make system independent of outside atmospheric pressure. Rotation, left hand only. Max. speed for continuous duty 3750 RPM. Displacement .484 cu. in. per revolution or approx. 4 GPM at 1750 RPM. **32.50**

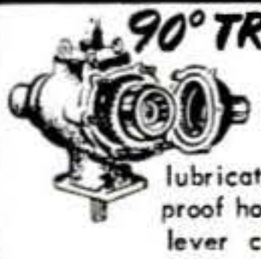
ELECTRIC GYRO

Turns up to 50,000 RPM. Electric drive motor is integral part of balance wheel. Has double end shaft to drive precision tools or machinery at precise, controlled speeds. Ball bearing mounted. Runs on high or low voltage. Ideal for experimental work, labs, hobbyists, technicians, etc. **4.95**

3 SPEED TRANSMISSION

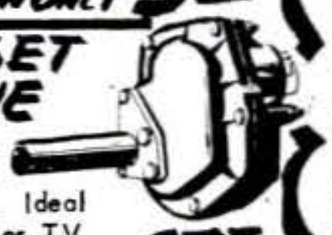
Converts a high RPM, low power input into low, RPM, high torque output. Has 2 take-off shafts at 4 to 1 & 16 to 1 ratio. Gear box has worm drive bronze gears & throw-out clutch. Will operate forward or reverse directions. Adaptable to many uses on power machinery. **19.95**

90° TRANSMISSION



Has 1½ to 1 gear reduction through bevel gears. Pre-lubricated bearings in dust proof housing. A positive lever controlled clutch... Size 7" x 6". 3/4" take-off shaft. NOW ONLY **3.95**

180° OFFSET GEAR DRIVE



For use where high power at low take-off RPM is desired. Ideal for revolving radio or TV antenna etc. Has 85 to 1 gear ratio. Used **6.75** New **12.95**

HYDRAULIC HAND PUMP

Handle operated. Operating pressure 1000 PSI. Capacity 1.6 cu. inch per cycle. $55.00 Value – Only **10.75**

AGASTAT TIME DELAY RELAY

Has 24v DC, energizing coil which operates a double pole, single throw relay switch. Holds circuit closed from fraction of second to 15 seconds by means of adj. set screw. Ideal for animated signs, displays, electric locks etc. **2.25**

GADGET MIXES

GADGET MIX – Rivets, Spacers, Bolts, Screws, Gears, Wheel bearings, Springs and Clamps. No. 106, 5 lbs. **1.19**

BEARING MIX. No. 170A. Approx. 20 needle, Ball & Roller Bearings, New & Used. Sizes: 1/2" to 4". Some of these cost Gov't $10 a piece. Never such a value! 5 lbs. ONLY **1.59**

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IMMERSION HEATER

Designed for installation in water base fluids, as in coffee urns, sterilizers, humidifiers etc. Has two copper-sheathed, tubular heat elements, silver soldered into head. A 3-heat type. 3000 watt. 230v, 2" pipe thread collar. A PALLEY Value **12.00**

WESTINGHOUSE AIR COMPRESSOR

1000's now in use for spraying, inflating, air tools, in garages, laboratories, shops & on trucks, tractors, jeeps, etc. Lightweight but powerful. Operates on ½HP, gas or electric motor Runs either direction. Delivers approx 3.27 CFM at 600 RPM or 6.54 CFM at 1200 Rpm. Has 2" bore, 1½" stroke.

We have motors, tanks and fittings to adapt this unit. **23.95**

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Rust resistant, alloyed steel. Extra flexible. Pre-formed, 7 x 19 strand. On reels.

1/16" – 4½¢ ft. (7x7)	7/32" – 10½¢ ft.
5/64" – 5¢ ft. (6x7)	1/4" – 12½¢ ft.
3/32" – 5½¢ ft.	9/32" – 15¢ ft.
1/8" – 7¢ ft.	5/16" – 16½¢ ft.
5/32" – 7½¢ ft.	3/8" – 18¢ ft.
3/16" – 9½¢ ft.	1/2" – 20¢ ft.

SPECIAL 3/16" cable, 18 feet long, with turnbuckle ends. . . **99¢**

Stainless Steel Cable – Pre-Formed
1/16" – 6¢ ft. 5/32" – 20¢ ft.
3/16" – 23¢ ft.

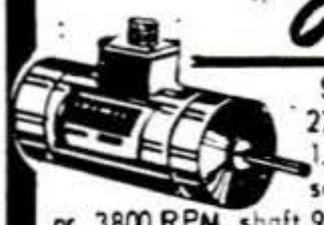
Bronze Cable – Not Pre-Formed
1/4" – 17¢ ft. 5/16" – 23¢ ft.
1/2" – 38¢ ft.

ELECTRIC MOTORS

606 – DELCO MOTOR

1/50 HP, 24v DC, 1.6 amp. turns 3000 RPM. Has adj. overspeed contactor to stabilize and control speed. Length 5½". Diam. 3". ONLY **4.95**

SAMSELL MOTOR



27 volts, 16 amps, 1/5 H.P. reversible, series wound on motor. 3800 RPM, shaft 9/32" diameter. 12-spline. 4-1/8" x 2-3/8". ONLY **3.95**

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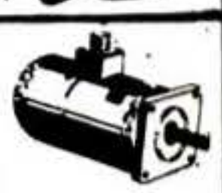


No. 500 – New 1/2 HP - 27 volt, DC–AC. This motor can be readily adapted to deliver up to 1/2 HP on 110 volts AC by the simple method of rearranging armature brush-leads. Free Diagram with each order. A SENSATIONAL VALUE. **5.95**

No. 500-A – Converted to 110 Volts, A.C. Equipped with plug and 3½ ft. heavy duty cord . . **8.49**

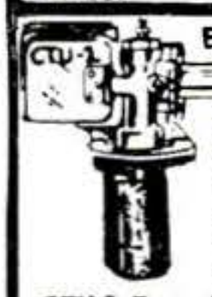
GEAR HEAD MOTORS

Heavy duty G.E Gear Head Motor. 1½ H.P., 24 volt D.C., 125 Amp. reversible motor will drive reduction gear box unit 40 to 1, resulting in 168 RPM at 5/8" diameter take-off shaft. Motor contains electro magnetic brake.

UNIT COMPLETE **10.95** MOTOR **4.95**
GEAR BOX ALONE **7.95**

LEAR GEAR HEAD MOTOR – Lear 24 volt DC, 7.6 amp, series wound reversible motor with overload clutch. Motor turns 11,000 RPM driving thru a 10 to 1 gear reduction box which turns the final take-off shaft 1100 RPM. Adjustable limit switches control limit of travel. Take-off shaft adapts to flex or rigid drives. **17.50**

ELECTRIC ACTUATOR



Hundreds of uses for any mechanical device needing controlled 2 way action. Opens, closes, raises or lowers doors... windows..gates..valves.

CTU-2 Foote Linear Actuator. 24V. DC, 8500 PPM, 1/6 HP - series wound motor. 4-1/2" stroke in 13-1/2 seconds. Compression & tension loads up to 750 lbs. Adjustable micro switch for limits of travel. Overall lgth. retracted 11 inches. **7.95**

EA-E1 – EASTMAN ACTUATOR– Has a 1/8 HP, 24 volt DC, 10,200 RPM motor and push-pull actuator. Actuator has 4" travel through a reduction gear box. Has adjustable limit switches & forward & reversing relays. Overall lgth. extd. 20", retracted 15½". **12.95**

FIRE EXTINGUISHER

Kiddie Lux – CO^2 Type. Built to Gov't specifications. Heavy, shatter-proof case. Recent hydro-static test Reconditioned and fully charged. LIKE NEW! READY FOR INSTANT USE!!

2 lb. size with Swing Nozzle . . **13.75**
3½ lb. size with Swing Nozzle . . **17.95**
7½ lb. size with Horn **23.75**
10 lb. size with New Squeeze Grip Handle & 3½ ft flex hose with Horn. **29.75**
15 lb. size with Squeeze Grip hdl, 4ft. flex hose, plastic horn.. **$42.50**
15 lb. size with Wheel Control . . **37.95**

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Use this top quality, precision built R–1 generator. An aircraft generator that originally cost the government approximately $400. Gives 300 to 400 amps at 27 volts. Ideal to convert for all welding, light or heavy up to 5/8" thickness. Free conversion instructions with each unit.

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What It's Like to Fly a Car

[Continued from page 77]

It's just that the new drive will be a lot lighter.

To make a successful flying automobile, he had to cool his air-cooled engine both aloft and aground. Speed did that aloft. He added a fan for ground operation.

He had to make the fastenings between his car body—or "road unit," as he calls it—and the wings and fuselage absolutely foolproof. He had to devise a propeller-locking device that would permit installation and removal in seconds.

Steering Wheel Moves Ailerons

He had to steer his front wheels aground with the same control wheel used for aileron movement aloft. That was a poser. For safe flying, he had to get full aileron travel with a quick quarter-turn of the wheel. But to retain that fast control in highway steering would have put a driver in the ditch on the first turn.

Fulton solved it by using a Geneva gear—the same device employed in movie cameras and projectors to move the film a frame at a time—to disengage the aileron control from the steering linkage. After the Geneva gear revolves a quarter-turn, sufficient for the ailerons, it releases the aileron control and continues rotating to turn the front wheels. The only noticeable result is a slight thump you can feel as the gear releases.

He had to put four-wheel brakes on the road unit but confine the braking on the plane to the two rear wheels. Braking on four wheels in a landing run would be hazardous.

No Fulton's Folly This Time

Fulton wasn't abashed by the size of the job ahead. He had a mechanical know-how in his bones. His father had been president of a truck-manufacturing company. An uncle started the first transcontinental bus line. Fulton grew up around the experimental department of his father's company and as a kid built his own motor scooters.

When, finally, he had whipped his problems and produced an automobile that would fly, duly approved by the Federal Civil Aeronautics Administration, critics were caustic: "It's not an automobile," they said, "and it's not an airplane. It's only a compromise."

"So's a car," replied the man who built it. "A car can't fly." END

Plastic Cars? Not Now!

[Continued from page 128]

such as custom sports bodies, it is more than offset because expensive steel-stamping presses are not needed. But in mass production the cost of presses is spread over a large number of bodies.

Plastic Production Limited

Also, plastics are limited in quantity. Resin production for 1952 is expected to be slightly above 1,300,000 tons. In contrast, the steel industry turns out almost 85 times that tonnage.

A major stumbling block is that all the production methods developed for plastic cars so far are too slow.

Automotive engineers say that the most practical means of mass producing plastic bodies would be post-forming—the quick and simple pressing of an already cured sheet of plastic laminate into body sections. This is not possible now because the best resins set permanently on curing and lose their formability. And glass fibers used in more durable plastics are not elastic enough for post-forming; if they were, they would lack strength.

Without a post-forming material, the all-important factor of time becomes a tough obstacle. The difference in time between steel pressing and plastic lay-up of auto bodies is hard to figure. A research engineer's very rough guesstimate of the time required for the Glasspar body is 14 man-hours. A steel body, complete and ready for the chassis, takes about 40 man-hours, but there are several hidden gimmicks. The Glasspar is an extremely simple body. And the plastics figure is for forming alone, while the steel-body time includes paint, all trim, and upholstery.

Praise for Plastics

Plastic experts agree with the auto industry that plastic bodies mass-produced in the Detroit manner are not practical now. But they are developing new powerful presses, new resins and new processes. When low-pressure operations can be speeded and perfected, and when plastics meet steel on even ground right down to the last second and the last decimal point and the last fastening, we will be a lot closer to mass-produced plastic auto bodies.

But right now, for this year and next anyway, that super-dingproof fender remains just a super-dingproof dream. END

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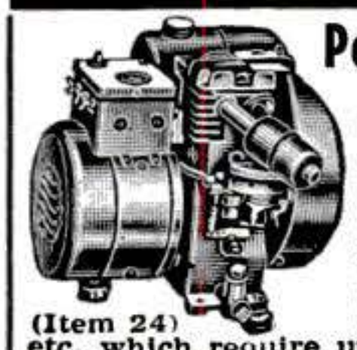

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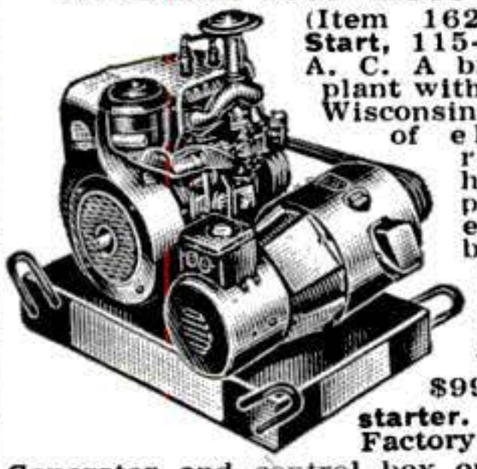

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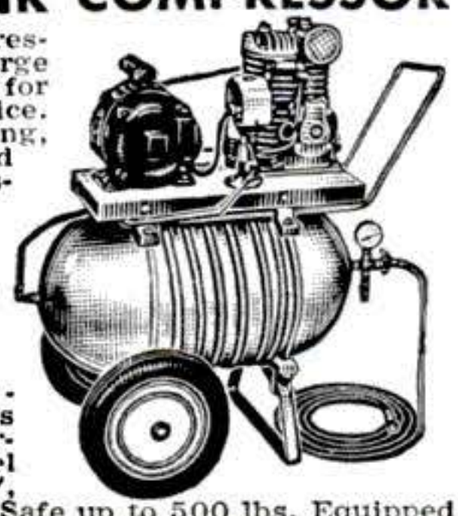

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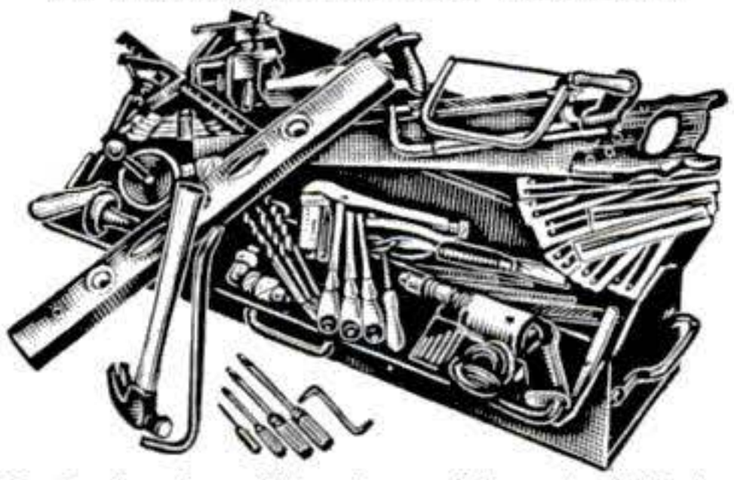

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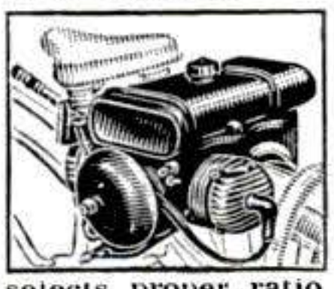

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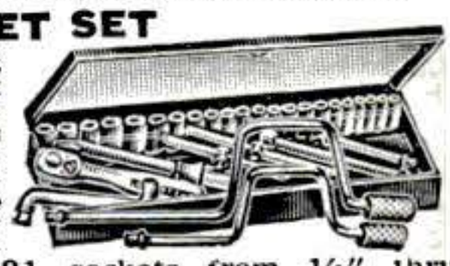

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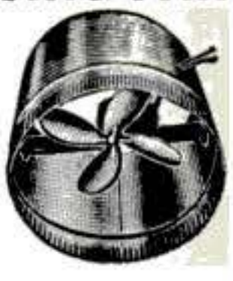

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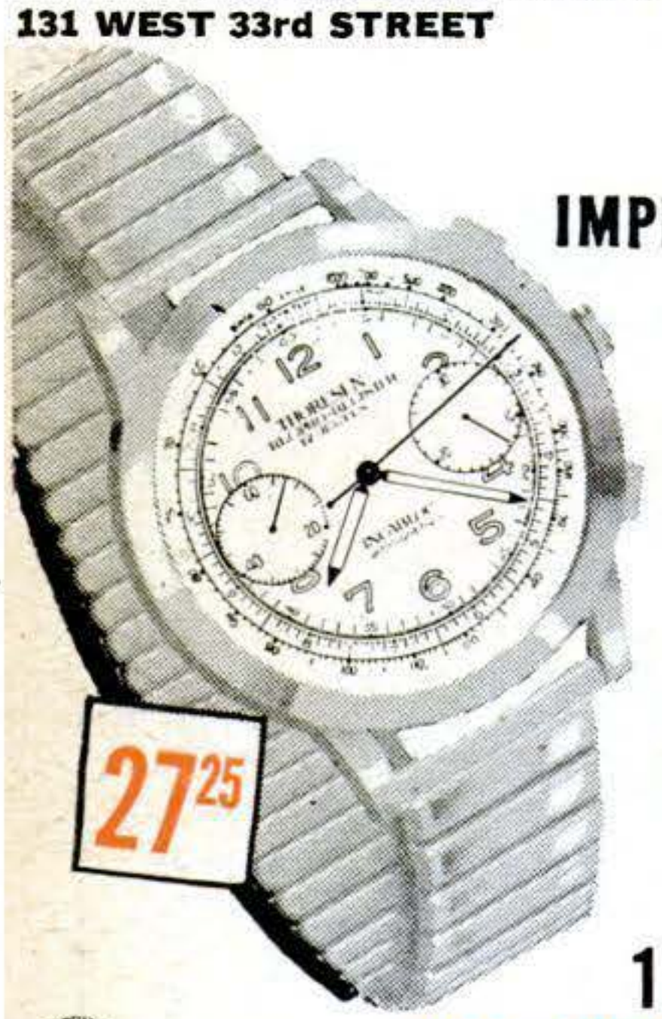

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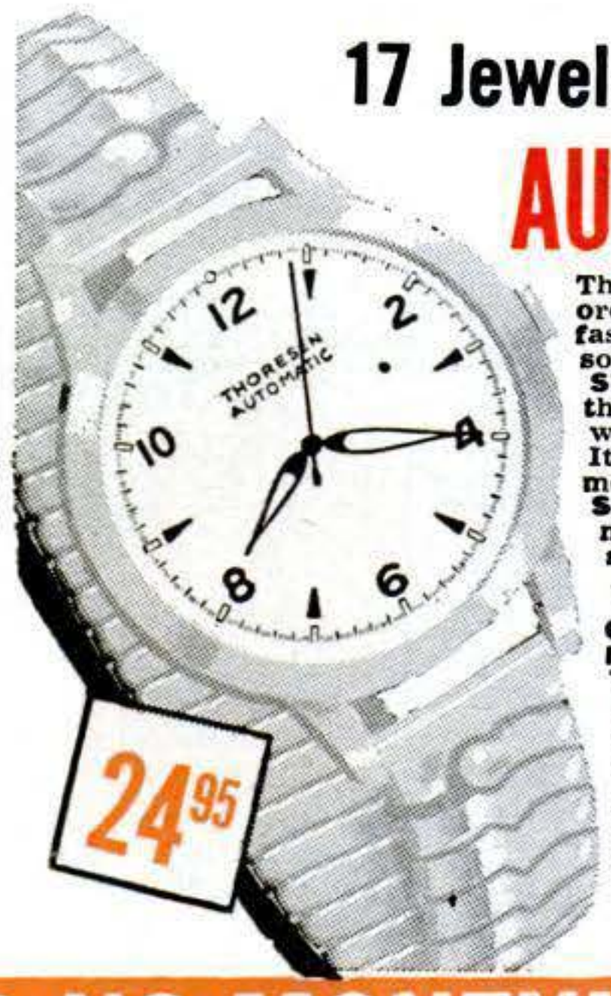

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New engineers can expect many attractive offers, can take their pick of jobs. Starting salaries of $100 a week. Industry desperately needs chemical, electrical and mechanical engineers. Will readily accept men trained by reputable schools.

DRAFTING

Opportunities are exceptionally good. Will get even better during the year. Qualified men due for rapid advancement. Quick training available for beginners. Aircraft, ship, electrical drafting head list of essential classifications.

BUSINESS

Outlook is especially bright accountants, federal tax exp traffic managers, typists, sten phers. Employers will put gr emphasis on specialized tra in effort to trim costs and st efficiency. Self-improvement be welcomed and rewarded.

You're too smart to stay in the same old You know that you have one life—that's al you've thought about *doing* something would advance you in your work, increase income.

The time to get started is *now*. And you take the first step toward Personal Success very minute!

Just look over the prestamped, preaddre card below and mark the I. C. S. course in field of interest. Then mail it—*today!*

We'll send you complete information on International Correspondence Schools, and they can give you the training you need to ahead faster. Cost is low, texts are easy to ur stand, and every student gets *personal* ser

The time to "take steps" is RIGHT N

ACT NOW! Mark and mail this paid postcard for complete informatio how I. C. S. can help you to success!

FREE HIGH SCHOOL BONUS

By taking a regular I. C. S. course, you can earn *bonus credits* toward a high school diploma.

You choose whatever course you want (there are 391 courses to choose from). Then, as you you automatically earn up to one-half the c required for an I. C. S. high school diplom extra work. No extra cost.

It's a free bonus you get with *every* I. C. S. c

"Net Profit-$75.56 ON VERY FIRST DAY!"

Reported Presto Salesman R. E. MEADE. "The sky's the limit" on Presto profits because of America's serious need for this new fire extinguishing discovery.

R. E. MEADE

"You should have named your extinguisher 'Miracle' instead of 'Presto.' I have never seen fire extinguished so quickly and thoroughly. My sample order of two dozen brass *Prestos* arrived late Thursday afternoon. Friday morning, in 15 minutes, I had orders for 18 extinguishers. Mind you this all happened in 15 minutes and without the first demonstration. By Friday evening the balance of 2 doz. were sold and orders taken for a dozen more. I had made a net profit of $75.56 the first day! Who said it couldn't be done? If you find such a man send him to me."
—R. E. Meade, Columbus, Ohio

"For every hour I have devoted to the 'Presto,' I find that I have earned an average of $15.20 an hour. I am devoting more of my time to this product now since I have discovered that the earnings on this item are greater than any item I have handled in the past."
—William F. Wydallis, Van Wert, Ohio

CHARLES KAMA
This Presto salesman from Texas was featured as "Salesman of the Month" on the front cover of a sales magazine. He told the magazine's reporter:
"I think I've succeeded pretty well. I'm making more than a thousand dollars a month—and I haven't touched bottom yet."

WOULDN'T YOU like to be making the kind of money R. E. Meade made? Of course, not everybody makes such profits on the very first day. But, how do you like profits like these: A Florida salesman earned $600 in one month. An Ohio man earned $2100 in 2 months. A New York salesman earned $1500 in one month. A New Hampshire salesman added the Presto as a *sideline* and picked up an extra $1800 in 20 months.

What is the Secret?

PRESTO contains an amazing new chemical "Chlorobromomethane" or "C.B." developed as a secret defense against fire during the war. In comparing the effectiveness of "C.B." in fighting various kinds of fires an authoritative testing laboratory states: "It has been proved that *'C.B.' is about 1.5 to 6 times as effective as other common extinguishing agents on an equal weight basis.*"

This extra effectiveness of "C.B." means that Presto can be made light and handy enough for even a woman or child to use. Just a twist of the knob . . . and flames disappear! "Sells on sight" to civil defense workers, owners of homes, cars, stores, farms, service stations, boats, motorcycles, factories, offices and to stores for re-sale.

Why Large Presto Profits Are So Easy

Everyone is terrified at the very *thought* of *FIRE! Every year* fire kills more than 11,000 people. Most people who see Presto in action want one or more — ESPECIALLY WHEN THE PRICE IS ONLY $3.98 EACH!

You can demonstrate Presto in a few minutes, and every sale will net you $1 or more. We refill your demonstrator free . . . and we give you dramatically powerful printed sales material to "talk from" . . . free certificates testifying that Presto is GUARANTEED FOR **20** YEARS.

Over One Million Presto's Already Sold!

YOU DON'T NEED TO INVEST A PENNY. Just collect and *keep* $1 or more every time you write an order—we collect the balance and deliver the extinguisher. (Or if you *wish*, you can buy from us at extra-low wholesale prices and then make up to $2.18 profit per unit supplying both dealers and retail customers—we'll send you free details.)

START NOW—MAIL COUPON

Get started in this rich new field now. Don't "put it off"! Every day you hesitate may cost you $10, $15, or even $50 you could otherwise be making. Mail the coupon at left NOW for everything you need to get started right away!

MERLITE INDUSTRIES, Inc., Dept. 117, 201 East 16th Street, New York 3, N. Y.

MERLITE INDUSTRIES, Inc., Dept. 117
201 East 16th Street, New York 3, N. Y.

Please send me illustrated sales literature, liberal profit plan, order blanks—everything I need to get started making good money introducing the Presto Fire Extinguisher in my locality.

☐ **CHECK HERE IF YOU WISH TO ORDER A REGULAR PRESTO TO BE USED AS A DEMONSTRATOR ($2.50).** Pays for itself many times over in increased sales. Can be returned as often as you like for FREE re-fill. You need'nt enclose any money now—we'll send Demonstrator C.O.D. (Or if you wish to save money, enclose $2.50 and we'll pay postage.)

Name.....

Address.....

City.....*Zone No. (if any)*.....*State*.....

IN CANADA: Mopa Co., Ltd., 371 Dowd Street, Montreal 1, P. Q.

Only Presto Has All These Features!

- **Ends Fire as Fast as 2 Seconds**
- **Chemical Contents 1.5 to 6 Times More Effective than Others on an Equal Weight Basis**
- **Weighs Less Than 1 Lb.**
- **Easily Held in One Hand —Even by a Child**
- **Needs No Inspection or Re-Charging—Does Not Corrode or Deteriorate**
- **Costs Only $3.98—Yet Out-Performs Bulky Extinguishers Costing Several Times as Much**
- **Automatic Pressure—No Pumping**
- **Guaranteed for 20 Years —Certificate is Packed with Every Presto**

Best Selling Months Are Here! Don't Delay—Mail Coupon Now!

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